MICRO-MAINFRAME CORPORATE IMPACT

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About INPUT

INPUT provides planning information, analysis, and recommendations to managers and executives in the information processing industries. Through market research, technology forecasting, and competitive analysis, INPUT supports client management in making informed decisions. Continuing services are provided to users and vendors of computers, communications, and office products and services.

The company carries out continuous and in-depth research. Working closely with clients on important issues, INPUT's staff members analyze and interpret the research data, then develop recommendations and innovative ideas to meet clients' needs.

Clients receive reports, presentations, access to data on which analyses are based, and continuous consulting.

Many of INPUT's professional staff members have nearly 20 years' experience in their areas of specialization. Most have held senior management positions in operations, marketing, or planning. This expertise enables INPUT to supply practical solutions to complex business problems.

Formed in 1974, INPUT has become a leading international planning services firm. Clients include over 100 of the world's largest and most technically advanced companies.

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MICRO-MAINFRAME CORPORATE IMPACT

MICRO-MAINFRAME CORPORATE IMPACT

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EXHIBITS

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I INTRODUCTION

I   INTRODUCTION

A.   BACKGROUND

- The micro-mainframe (M-M) issue consistently scores high in INPUT's client polls. In 1985 interest continued to climb, assisted by a barrage of vendor announcements which have made it difficult to identify and understand key issues and to determine which, if any, micro-mainframe path to take.

- The growing proliferation of corporate-based microcomputers is fueling end-user demand for access to large company computers, and there is growing appreciation of the productivity made possible by this connection. However, recognizing and understanding the potential problems these linkages can cause is only beginning.

- INPUT believes M-M is the first logical step in distributing mainframe information to end users and, as such, becomes more than a question of, for example, terminal emulation or screen versus file transfer.

  - The additional issues emerging involve the impact of increased micro-mainframe applications and communications facilities, ease-of-use, security, and maintaining central data base concurrency.

  - Also, timing issues need to be addressed. Should M-M be implemented now or should information systems (IS) wait for new products?

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- This study generally assumes that the micro-mainframe world is an IBM or compatible world.

    - INPUT acknowledges that the assumption remains somewhat debatable. For example, Apple's plans to place Macintoshes in corporate America, AT&T's continuing computer efforts, and other vendor participation may provide a basis for corporate M-M strategies. However, two key points need to be made:

        - IBM's current interconnect strategy provides an underlying environment for IS.

        - Equally important are the views held by IS. The non-IBM compatible share of corporate micros is expected by IS management to be very low compared to IBM and compatibles.

    - This does not mean there is no place for innovative micro hardware in Fortune 1000 corporations, but from the M-M standpoint, such devices must generally be transparent to IBM networks for easy use and acceptance.

B.   METHODOLOGY

- The report research was conducted in parallel with that for four other related reports (see Section D below). The research consisted of:

    - Client interviews.

        - INPUT clients were sampled to determine areas of special interest and to learn of their experiences, problems, and needs.

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- Corporate interviews.

  - Approximately 130 structured interviews were conducted with IS managers at large corporations in March 1985.

    - The questionnaire used is in Appendix A.

    - Company sizes and industries are shown in Appendix C.

  - In addition, INPUT had the opportunity to review 20 companies in depth with some of their experiences described in the report, while other information was used to inform our analysis and recommendations.

  - In the past two years, INPUT has conducted a number of consulting studies bearing on M-M issues. While no proprietary information is revealed, the knowledge gained is represented here.

- Vendor interviews.

  - Structured interviews were conducted with vendor personnel from 25 companies. The questionnaire used is in Appendix B.

- Product and service analysis.

  - INPUT collected and analyzed information on over 100 M-M products and services.

  - Of course, the continuing change represented by new products means that this report risks obsolescence upon publication. Some announced products may never be brought to market.

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Product introductions will continue, with offerings expected from LAN vendors and various software companies.

. Vendors are even promoting modems and communications software as M-M products, causing further confusion over just what micro-mainframe really is.

. Nevertheless, the issues discussed here remain valid despite the dynamic forces at work in the industry.

C.   SCOPE

● This report, produced by INPUT's Corporate Systems Planning Program focuses on the strategic issues related to the micro-mainframe technology. This technology includes:

- Micro-to-mainframe.

- Micro-to-mini-to-mainframe.

- Micro-to-LAN-to-mainframe.

● The report addresses the following topics:

- A review of the potential applications of micro-mainframe technology, including an analysis of the information needs of the most likely micro-computer user candidates, along with the trends in the M-M market and product evaluation criteria (Chapter III).

- A study of the pros and cons of linking microcomputers to mainframes as perceived by the research respondents. An analysis of the long-term

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effect the M-M concepts will have on the structure of the IS organization, including possible decentralized functions, and a discussion of planning steps that IS should consider to provide leadership to the M-M activities (Chapter IV).

- An in-depth analysis of IBM's strategies relative to the integration of personal computing, office automation and data processing, along with a comparison of similar functions offered by the leading office systems minicomputer vendors. A review of representative micro-mainframe products of the leading vendors in this market (Chapter V).

- Recommendations for the development of a top-down micro-mainframe plan that emphasizes the corporate view and also is responsive to the immediate needs of the end users (Chapter VI).

D. RELATED INPUT REPORTS

● Interested readers are referred to the following INPUT reports:

- Micro-Mainframe: End-User Experiences (1985) describes various M-M methods, their advantages and limitations, suggests implementation strategies, and projects changes in the technology marketplace.

- Micro-Mainframe: Software (1985) categorizes the M-M software products necessary to accommodate M-M access, with special attention on security and data integrity requirements. The report recommends a software development/acquisition strategy.

- Micro-Mainframe: Connectivity (1985) describes the complex communications considerations affecting micro-mainframe, recommends planning for the impact of M-M on corporate networks, operational steps to management network resources, and cost control measures.

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- *Micro-Mainframe: Market Analysis* (1985) segments the market and provides projections for terminal emulation and intelligent packages, and analyzes issues, events, and trends in the marketplace.

● These reports update a similar series published by INPUT in 1984:

   - *End-User Micro-Mainframe Needs* examines end-users experiences through case studies, forecasting future product directions, and the major technological and planning issues identified, with recommendations focusing on the technical, communications, and security aspects of micro-mainframe.

   - *Personal Computer to Mainframe Market Opportunities* (1984) addresses and analyzes micro-mainframe developments and the impact they will have on the microcomputer industry. Includes discussion of the changing applications environment, market directions and needs, competitive environment, customer requirements for vendor support, market forecasts, and strategic recommendations.

   - *Micro-Mainframe Processing Services and Turnkey System Market Opportunities* (1984) addresses opportunities and challenges faced by processing services and integrated systems vendors, analyzing the threats these suppliers face from microcomputers.

   - *Micro-Mainframe: Telecommunications* (1984) addresses the telecommunications components of micro-mainframe.

● Other relevant studies are:

   - *Destiny of the Information Center (IC)* (1985) examines the impact of the microcomputer and end-user computing on the future of the IC.

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- <u>Integrating Voice and Data Communications</u> (1985) analyzes the changing technologies of telecommunications, the benefits and costs of integration, the evolution of LAN, CBX, and other devices, and provides guidelines to when data-only networks are most appropriate.

- <u>LAN/CBX Trends: Decision Processes for Users</u> (1984) describes current and future product trends and presents a planning process for managers to ensure successful implementation of a strategy meeting corporate needs.

- <u>LAN/CBX: Planning for Change</u> (1985) reports current experiences with these data and data/voice communications technologies and looks at the future of office-oriented communications devices.

- <u>Office Videotex</u> (1985) examines corporate, in-house applications for this user-friendly technology which has so far failed to make an impact as a new consumer-oriented media.

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II EXECUTIVE SUMMARY

II   EXECUTIVE SUMMARY

- This Executive Summary is designed in a presentation format in order to:

  - Help the busy reader quickly review key research findings.

  - Provide an executive presentation and script that facilitates group communications.

- The key points of the entire report are summarized in Exhibits II-1 through II-8. On the left-hand page facing each exhibit is a script explaining the exhibit's contents.

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A. DEMANDS FOR MICRO-MAINFRAME (M-M) LINKS WILL INCREASE

- INPUT is predicting that the microcomputer will become a strategic component of future integrated electronic office systems. These future systems will allow users to transmit documents, data files, images, voice messages, and graphics to workers in the next office, next state, or next continent. The microcomputer user will have the ability to select and extract data from any source connected to the internal or external networks. The users will develop systems to support their own functions and to support production operations of the corporation.

- The aforementioned systems scenario can only happen through micro-mainframe link technology. This technology is in the process of evolving and encompasses a variety of linkage combinations, including:

    - Micro-to-mainframe.

    - Micro-to-mini-to-mainframe.

    - Micro-to-LAN-to-mainframe.

    - Micro-to-cluster controller-to-mainframe.

- The current linkage activity is concentrated on providing a limited number of end users with the ability to emulate a video display terminal through their microcomputers and download screen images or predetermined files for use with widely accepted personal computing software packages.

- During the next two to ten years, there will be a steady move toward the integration of data processing, office automation, and personal computing. As the demand for micro linkages increases, the products will deliver more functions and features, and standards will emerge.

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EXHIBIT II-1

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DEMANDS FOR MICRO-MAINFRAME LINKS
WILL INCREASE

**DP, OA, PC
Integration**

**Extract and
Reformat
Data Base
Fields**

**Download
Screens
and Files**

**Current
Concentration**

Terminal Emulation

**Standalone
Microcomputer**

Increasing M-M Functions

M-M Stages Over Time

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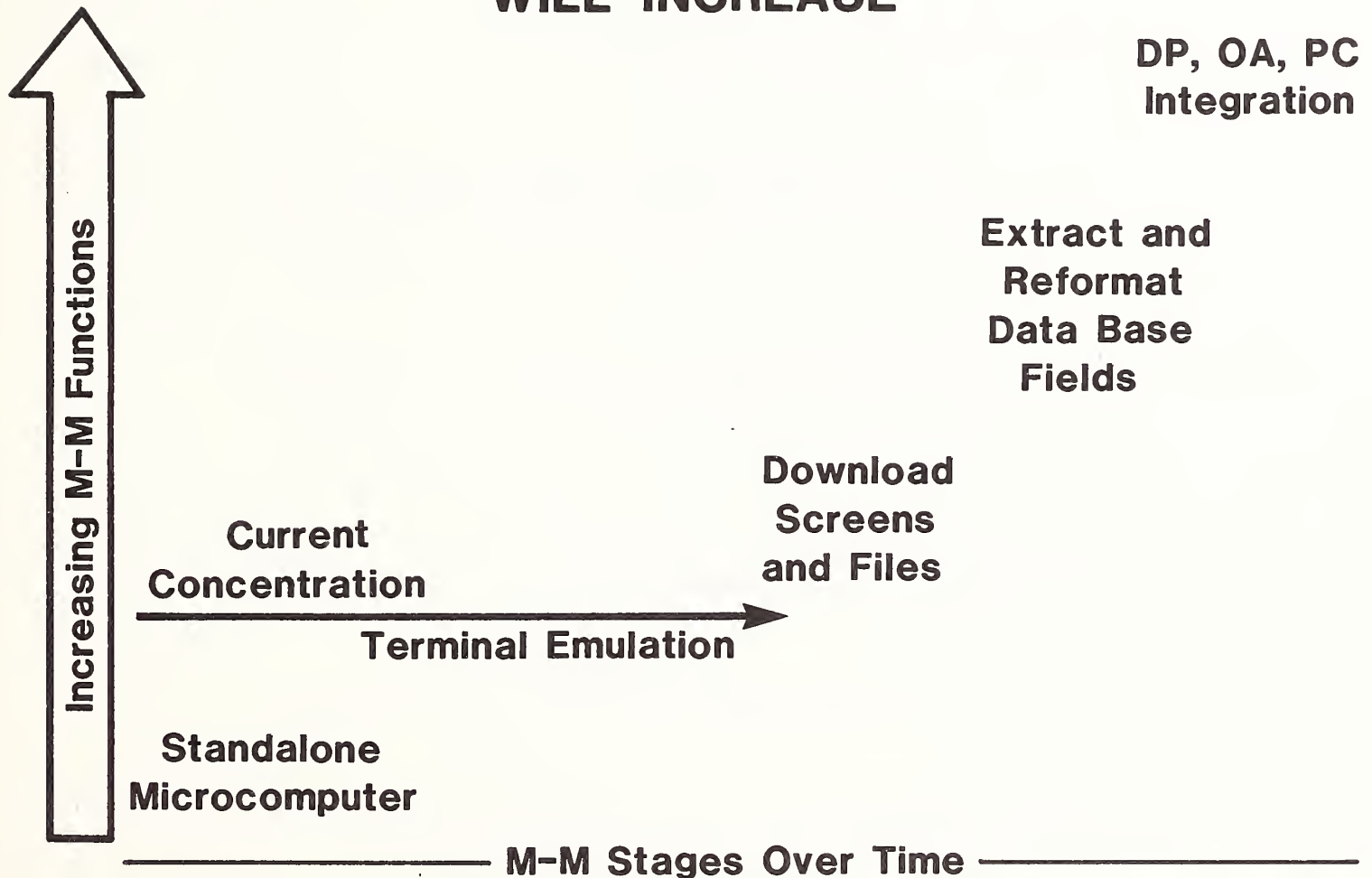
B. WHAT ARE IMPORTANT MICRO-MAINFRAME CHARACTERISTICS?

- There are literally hundreds of products on the market that are related to the problem of connecting microcomputers and mainframes. The probability of identifying one linkage product that could satisfy all potential micro-mainframe applications is highly unlikely. However, if criteria is established to which each product must adhere, the number of different linkage software packages can be kept to a minimum.

- First and foremost an M-M product must be compatible with the current mainframe and microcomputer environment, which includes:

  - Operating systems.

  - Teleprocessing monitor software.

  - Mainframe data management systems.

  - Microcomputer file formats.

  - Local and remote communications.

- The M-M software should allow queries from the microcomputer to specific host-stored data elements with selection parameters. The microcomputer user should have the ability to udpate mainframe data bases and files, even if it is a batch file upload for later updating.

- The microcomputer portion of the M-M software should be designed for use by non-technical users. This should include a menu-driven scheme and "help" features. The data selection and extract functions should require minimal IS customization. This can be determined by comparing the customization requirements of the products being evaluated.

- The M-M software should also support the data access security procedures and software currently in place.

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EXHIBIT II-2

WHAT ARE IMPORTANT M-M CHARACTERISTICS?

- **Supports Current Environment**

- **Provides Both Inquiry and Update Functions**

- **Provides Non-Technical User Interfaces**

- **Requires Limited Customization**

- **Utilizes Existing Security**

C.   WHAT ARE THE PROS AND CONS?

- There are some obvious benefits derived from the investment in micro-main-frame software. The manual keying of data from hard copy reports onto microcomputer disks is eliminated and replaced with electronic access to mainframe data bases and files. Not only is labor saved, but the users need not wait for reports to be produced and distributed, which means the decision support activity can be more timely.

- As M-M concepts start to encompass more of the office systems tasks and data processing functions, the backlog of requests for information systems services could be reduced and end-user productivity could improve. The end users will become more involved in designing and developing operational production systems through microcomputer prototyping and fourth generation languages.

- Security and data integrity heads the list of potential problems associated with allowing end users access to corporate data bases and files. If existing procedures and methods are followed, this should not be a major concern. End users must be made aware of, and be responsible for, the potential risks of not securing floppy disk files containing corporate information.

- The deeper the microcomputer penetrates the personnel ranks of an organization through M-M links, the greater the training task becomes for IS. INPUT has recommended the formation of a formal IS training function to handle this issue.

- Until departmental file servers or distributed data processing expands, the M-M activity will cause a capacity problem on the host mainframe; there will also be a demand for more IS technical support.

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EXHIBIT II-3

WHAT ARE THE PROS AND CONS?

Micro-Mainframe Links	
Pros	**Cons**
Data Availability	Security/Data Integrity
Data Timeliness	Increased Training
Reduced Backlog	Mainframe Capacity Problems
Improved End-User Productivity	Increased IS Support

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D.   BEWARE OF HIDDEN COSTS

- License fees for micro-mainframe links can cost anywhere from $10,000 to $150,000 for the mainframe portion and from $200 to $2,000 for each micro-computer being linked. On top of these one-time fees are the IS technical human resource costs required to make the links operational. A less expensive link may not provide any means for selecting and extracting specific data from the host files. Data base selection and extraction commands could take a data base administrator, or equivalent, a couple of days to develop for each end-user request. It may be easier to justify and to obtain approval for the acquisition of the less expensive linkage software, but the added customization costs could far exceed the one-time fees of the more advanced micro-mainframe software.

- Most of the initial requests from end users for the transfer of mainframe stored data to their microcomputers will add an extra burden on the main-frame processing and disk space capacity. Each selection and extraction request from a micro user will add processing requirements to the mainframe and will require disk space either for a holding area or for virtual floppy disk space. This capacity problem will not be relieved until file servers are installed between the micros and the host or until some of the production data processing tasks are offloaded to the micros or departmental processors.

- The microcomputers can physically connect to IBM mainframes as 3278 or 3279 terminals through the use of an add-on printed circuit board and coaxial cable connected to the IBM 3270 controllers or through RS232 ports and modems connecting a communications line. If the microcomputer is not taking the place of an existing video display terminal, then the asynchronous or synchronous products are additional costs which can range between $500 and $2,500 per micro. Additional 3270 terminal controllers may be required to accommodate the linked microcomputers, and communications costs will increase due to the remote microcomputer traffic.

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EXHIBIT II-4

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BEWARE OF HIDDEN COSTS

Visible	Hidden
• **License Fees**	• **Customization**
• **Async/Sync Hardware**	• **Host Capacity**
	• **Network Load**
	• **Controller Capacity**

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E. MICRO-MAINFRAME DRIVING FORCES

- IS has found itself in an unusual situation relative to the use of micro-computers in corporations. Normally, IS is the champion of innovation and the driving force behind the introduction of change. In the case of the micro-computer, however, the impetus originated with the end users.

- Through the information center, IS has provided support to the microcomputer users. At present, the driving force behind micro-mainframe activities also stems from the end users. The first group to recognize the need for micro-mainframe links has been the knowledge workers--the financial analysts and business planners. IS has been concentrating its micro-mainframe efforts on satisfying these decision support requirements.

- The next category of workers that could benefit from microcomputer access to corporate data is middle management. This group needs to continually monitor the performance of the business operations against the established plans and make tactical adjustments accordingly. INPUT is predicting that this demand will surface within the next one to three years.

- The executives are not inclined to sit at a microcomputer workstation and grapple with corporate data and spreadsheet software. IS will need to develop predetermined screen formats to allow the executives a quick view of the status of major projects. These custom micro-mainframe systems may not emerge until IS has had more experience with micro-mainframe applications.

- The demand that will require top-down planning and considerable IS support will be the integration of microcomputers into production-transaction-driven systems. This micro-mainframe activity will not prevail for several years because it will involve major rewrites of existing production systems.

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EXHIBIT II-5

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M-M DRIVING FORCES

Demand	Source	Priority
Decision Support Strategic Planning	Business Analysts/ Planners	Immediate
Performance Measurement Tactical Planning	Middle Management	1-3 Yrs.
Project Status Strategic Overview Forecasting	Executive Management	2-5 Yrs.
Transaction Processing	IS	> 3 Yrs.

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F.   HOW WILL M-M IMPACT I.S.?

- During the past few years the use of standalone microcomputers has continued to increase, and by 1985 there were several million such devices in companies across the nation. During the same period, IS organizations have been establishing end-user support groups or information centers. The end users have been autonomously developing microcomputer applications with technical assistance from the information center.

- By 1987 nearly half of the installed base of microcomputers in corporations will be connected to a mainframe, either directly or through a LAN connections. Coordinating this surge of micro-mainframe activity will require collaboration between the IS end-user support staff and the systems development staff to control and customize queries.

- INPUT is predicting that by 1990 the electronic office period will prevail and will be characterized by the integration of data processing systems, office automation systems, and personal computing systems. To accommodate this period, the IS organization will need to change its structure.

- File and communications servers will become commonplace and located throughout the corporation to offload the micro-mainframe demands. The end-user support group will merge with the systems development group to exploit the full potential of the microcomputer. Small mainframes may be distributed among departments to handle the integrated electronic office processing. Systems development may also be distributed to the operating business units. Training will become one of IS's major tasks.

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EXHIBIT II-6

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HOW WILL M-M IMPACT I.S.?

1983-1985

1987

1990-1995

| Information Center (IC) | Systems Development (SD) | Data Center | PC |

| IC | SD | | Data Center — PC |

| IC/SD Integration | Data Center | Dept. Processor | PC PC PC |

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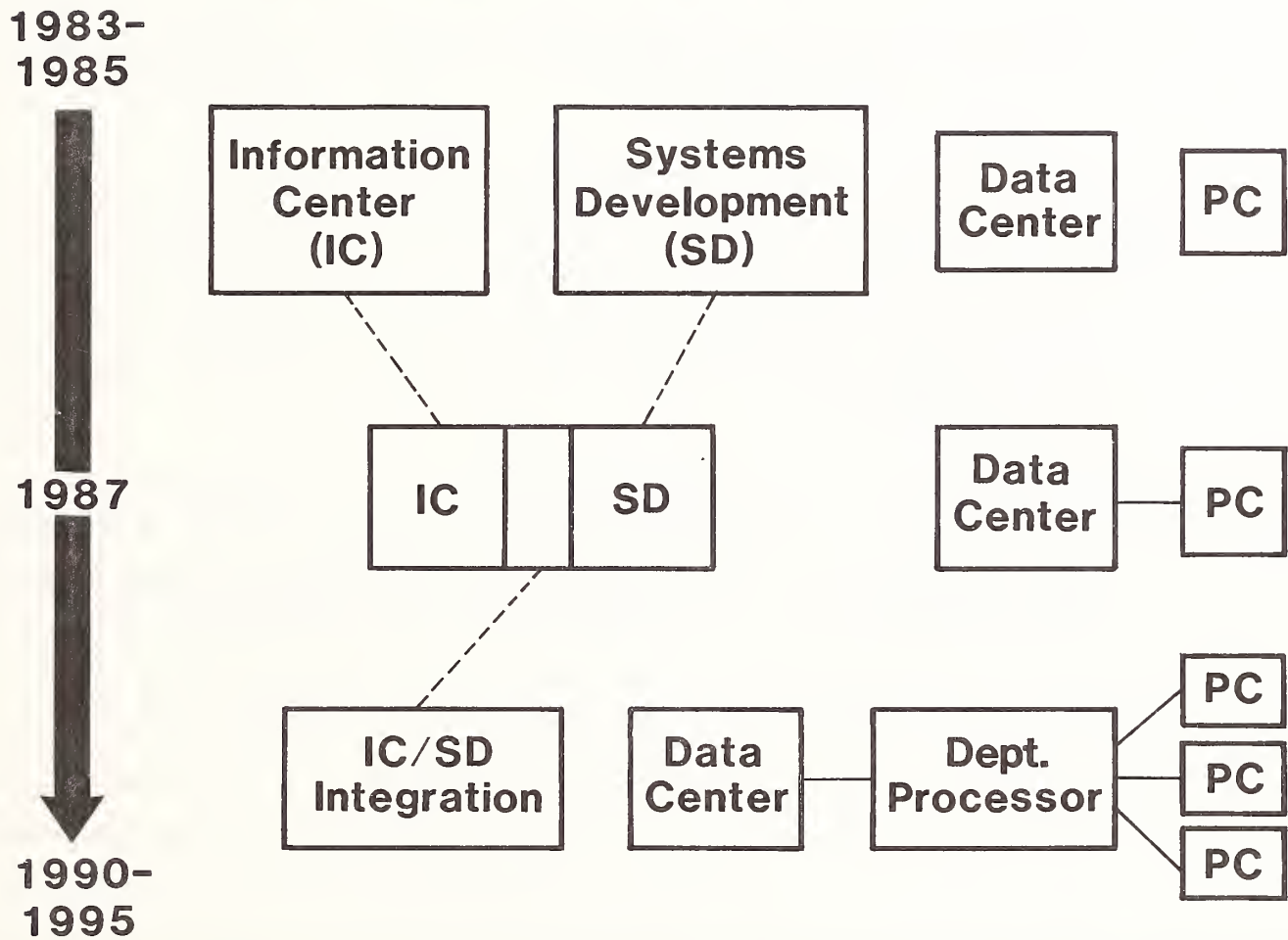
G.   WHAT ARE IBM'S LINK STRATEGIES?

- IBM has positioned the System/36 as the link between office systems and the host mainframes. The reason that IBM selected the System/36 for the role of file server at a departmental node in the SNA network is because it was designed for small businesses and required minimum technical support to be operational.   The PC AT/370, with its concurrent operations support, file sharing capabilities, and greater speeds and storage capacity, is IBM's entry for the electronic office.

- IBM is in the process of releasing software products that will provide advanced text processing, library services, and document distribution among the host mainframes, personal computers, and System/36s. Personal services are applications that provide mail management to IBM PC and System/36 users via DISOSS.

- DisplayWrite 3 and DisplayWrite/36 are IBM's latest advanced word processing packages for the PC and System/36, respectively.   DisplayWrite offers revisable-form document exchange between the two computer systems. A PC can be connected to DisplayWrite/36 through 5250 emulation.

- The IBM Personal Decision Series (PDS) consists of six personal computing software packages, including a data manager, report generator, a spreadsheet, word processor, and graphics. Attachment/36 and Attachment/370 are the IBM link packages that allow files of data to be exchanged between the PCs and the two host systems.

- IBM's Document Interchange Architecture (DIA) handles the protocols and data structures being transmitted among the SNA nodes. Advanced Program to Program Communications (APPC) is an enhancement to SNA to provide standard application interfaces and peer-to-peer communications between workstations and mainframes.

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EXHIBIT II-7

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WHAT ARE IBM'S LINK STRATEGIES?

Category	Products	
Hardware	– S/36	– PC AT/370
Software	– DisplayWrite	– Personal Services
Network	– SNA/SDLC	– APPC
Protocols	– DIA/DCA	– DISOSS
M-M Links	– PDS Attachment/36/370	

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H.   TOP-DOWN PLANNING IS A MUST

- The vendors and the end users have been driving the micro-mainframe market. It is now time for IS to determine how these innovations can best benefit the corporation. It is time to bring the end users, the IS systems developers, and the IS end-user support staff together to provide direction to the micro-mainframe revolution.

- Plans should be developed in light of the potential integration of office automation, data processing, and personal computing. In an environment of distributed file servers and departmental processors, potential applications should be identified along with the potential benefits.

- Alternate network topographies should be evaluated and additional resources identified for each node. Implementation plans and schedules should reflect a phased approach based on application priorities.

- Each phase should have the startup and ongoing operational costs identified. These ideas, costs, and timetables should be presented to the IS steering committee (or equivalent) for approval.

- The challenge for IS is to become the champion of micro-mainframe innovations and provide the leadership and technical support to ensure the most beneficial applications of these concepts.

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EXHIBIT II-8

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TOP-DOWN PLANNING IS A MUST

- **Form Micro-Mainframe Task Force**

- **Identify Potential Applications**

- **Evaluate File/Comm. Servers and DDP**

- **Identify Hw/Sw/Comm. Requirements**

- **Develop Justification Criteria**

- **Establish Priorities and Schedules**

- **Obtain Steering Committee Approval**

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III HARNESSING THE MICROCOMPUTER POWER

III HARNESSING THE MICROCOMPUTER POWER

A. FUTURE CORPORATE SYSTEMS AND THE MICRO

1. THE STAGES OF MICROCOMPUTER USAGE IN BUSINESS

- The microcomputer entered the corporate scene only a few years ago (circa 1980) and already has evolved through at least six stages of service levels.

    - The first stage saw microcomputers from Osborne, Tandy, and Apple trickle into various levels of managers and professional workers through the normal office equipment purchase order procedures. The end users worked directly with the retail distributors of personal computer products and tended to learn how to use single micro-specific application software on their own. Most of the applications in the early days were related to word processing and simple spreadsheet calculations. This sporadic acquisition of single-purpose micro-computers was met by the IS department with indifference.

    - During the second stage, the microcomputer software vendors seized the opportunity to market products with greater functionality and compatibility. This opportunity was created by the demands of the microcomputer users for improved functions and the ability to move data readily between those functions. Users were looking for packages that shared common data formats and user interfaces and provided

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electronic spreadsheet, word processing, data management, and business graphics. The trickle of microcomputers into corporations became a steady stream and both IBM and IS became concerned with this onrush. IBM was quick to respond with its PC family of micro-computers, and IS started controlling the proliferation of micro-computers by getting into the purchase acquisition approval loop and by issuing compatibility standards to govern micro hardware and software products.

- Once IBM became entrenched in the business world with its PCs and IS started providing training and guidance to the microcomputer end users, a new demand was voiced to connect the PC to the mainframe. This allowed the PC to act as a dumb video display terminal. So, stage three saw the installation of add-on printed circuit boards and RS-232C serial ports and modems to allow end users local and remote access to mainframes for data queries from their IBM PCs. This provided only a view of the data with no downloading or uploading capabilities.

- It was only a matter of time before stage three crossed over to stage four and end users were beginning to ask for data stored in mainframe files to be transferred to their microcomputer disks. This was a cumbersome process and required custom programming by IS personnel to build a special file for the end-users' needs. Once the bulk file was transferred to the microcomputer, programs had to be written to make the data fit the microcomputer software formats. As inconvenient and time consuming as this file transfer was, it was still more efficient than rekeying data into the microcomputer disks from computer printouts.

- Stage five brought an onslaught of products under the title of micro-mainframe links. There are now literally hundreds of such products on the market. New ones are being announced almost every week and the old ones (over a year old) are being enhanced. The vendors of main-

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frame software and the vendors of microcomputer software are both facing the challenge of building bridges between the micros and the mainframes that will allow interactive sharing of the two resources. The biggest problem facing these two types of vendors is hurdling the incompatible data formats. The personal computer application software vendors have developed their products around unique formats, as have the mainframe applications and data base software vendors. Most of the major mainframe software vendors have developed and are marketing links that provide access to and reformatting of data stored in their proprietary products' formats for transfer and use in many of the most popular microcomputer application software formats. Unfortunately, the vast array of applications in production at any one data center makes a single micro-mainframe solution implausible. Simple generic links that are based on the virtual floppy disk concept will normally require custom programming for data selection and reformatting. Sophisticated generic links, such as Tempus-Link, will require technical support to take full advantage of the features.

- As depicted in Exhibit III-I, INPUT believes stage six of the use of microcomputers in business will be represented by a true integration of the micro and mainframe to provide the most effective solution to the future information systems problems. The microcomuter will become an extension of the mainframe and will perform many of the front-end and back-end tasks of operational production systems, heretofore handled by the mainframe. There may be file servers or departmental processors between the micros and the mainframes, but future systems architecture will take advantage of the microcomputer capabilities. Management Science America, Inc. (MSA) has just recently annoucned their newest category of micro-mainframe software called Distributed PC Applications, which will offload some of the normal mainframe data processing tasks onto the microcomputer. Up until now, micro-mainframe link activity has placed an additional burden on the main-frame capacity because the many individual requests for data has been

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EXHIBIT III-1

EVOLUTIONARY STAGES OF MICROCOMPUTER USAGE IN BUSINESS

Mainframe and PC Integrated Functionality

Selected Mainframe Data Plus Reformatting

Bulk Transfer of Mainframe Files to Micros

PCs Emulating IBM 3270 VDTs

Integrated Micro Software

Standalone
Micros-Single
Application

1

IBM PCs, IS Control

2

Mainframe Data Base Inquiries

3

4

5

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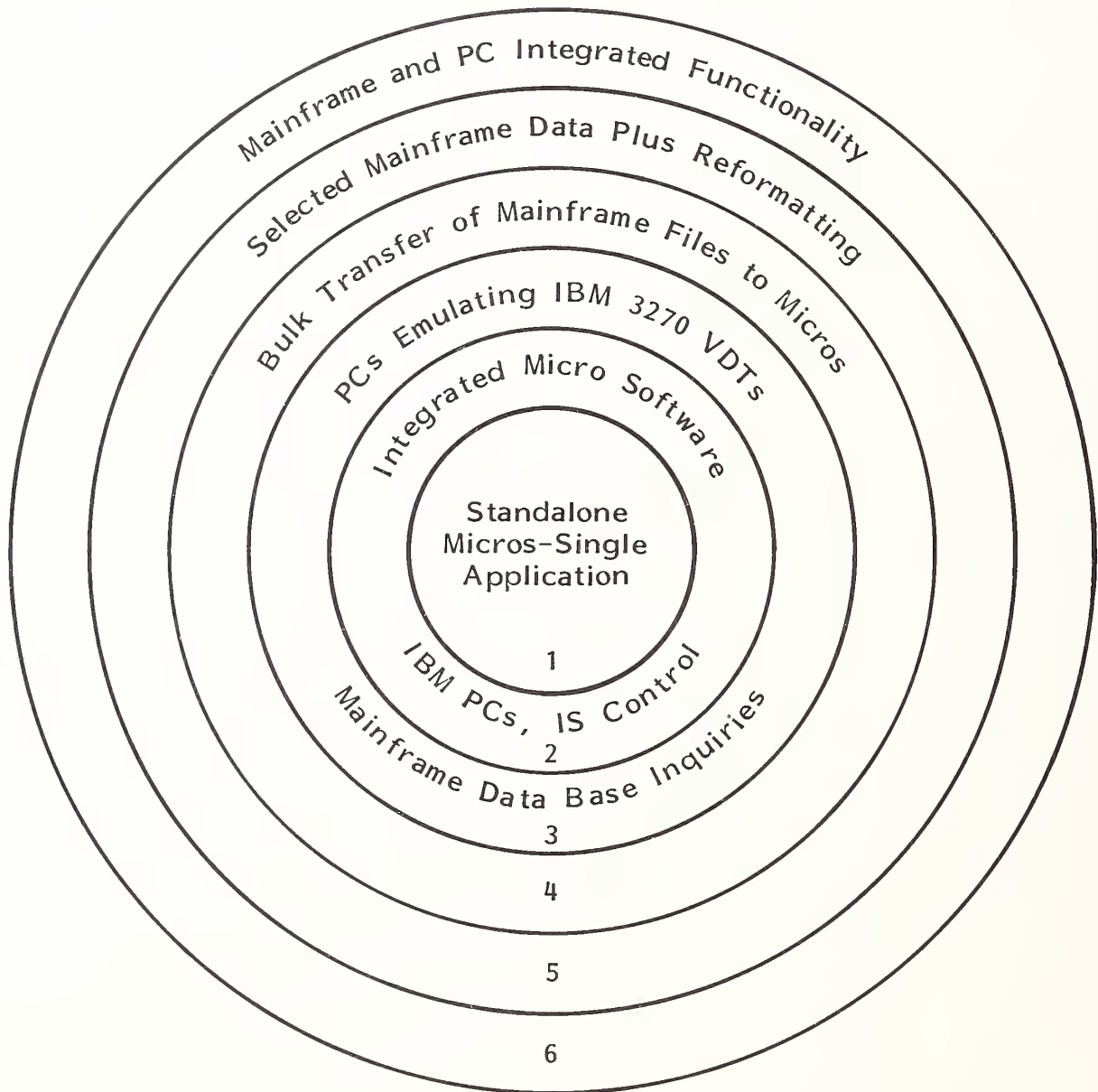
unanticipated and unrelated to production processing. If much of the data collection and information analysis processing can be transferred to the microcomputer, communications costs and requirements for mainframe power could be reduced.

2. SUPPORTING THE DECISION MAKERS

- Throughout the evolution of computers in business, IS has concentrated its efforts on developing and processing transaction-driven systems. The objectives have been to increase overall productivity, reduce operating costs, produce a superior product in the shortest time possible, and improve customer relations. Mature IS organizations spend the majority of their development time modifying existing production systems to provide improvements to these basic objectives. Once every five to ten years the entire system is discarded and a new one is implemented to take advantage of the latest technologies.

- IS has tried to align itself more as a strategic rather than a supportive entity, and even changed its name from data processing to management information systems during the 1960s. The name change had little effect on IS's ability to deliver decision support systems. Management information was still historical data that had to be manually reworked to analyze the impact of various business strategies. The financial analysts and business planners turned to remote computer services vendors to build and analyze sophisticated business models.

- The advent of the information center concept and the ever increasing use of personal computers in corporations, plus the demand for decision support systems, have brought a rash of products for both the mainframes and the micros that provide end users with such functions as:

    -   Financial modeling.

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- Statistical analysis.

- Econometrics.

- Forecasting.

- Graphics.

- Reporting.

- Data management.

• The latest name given to these end-user systems is managerial support systems. This has come about because more and more of the management ranks are relying on information technology for support in the day-to-day duties of running an organization. Exhibit III-2 graphically illustrates the changes in computing requirements as the corporate hierarchy is ascended. At the bottom, the clerical staff processes data transactions on a routine, repetitive basis. As computing moves to the top, corporate-wide information is required to provide the knowledge needed to make decisions in a constantly changing environment.

• Most top executives do not personally get invovled in utilizing computer-based decision support systems. Instead, they look to their subordinates to provide the knowledge they require to make strategic decisions. Questions from executives are passed on to the knowledge workers who know how to use the computer-based decision support tools. Because of the growing use and capabilities of the personal computers, many of the mainframe decision support systems vendors are offering subsets of their products for the micro-computer. Exhibit III-3 provides a few examples of this practice.

• The weakest link in today's management support systems is data support. To answer the strategic questions posed by the executive staff, the analyst

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EXHIBIT III-2

END-USER COMPUTING MOVES TO THE TOP

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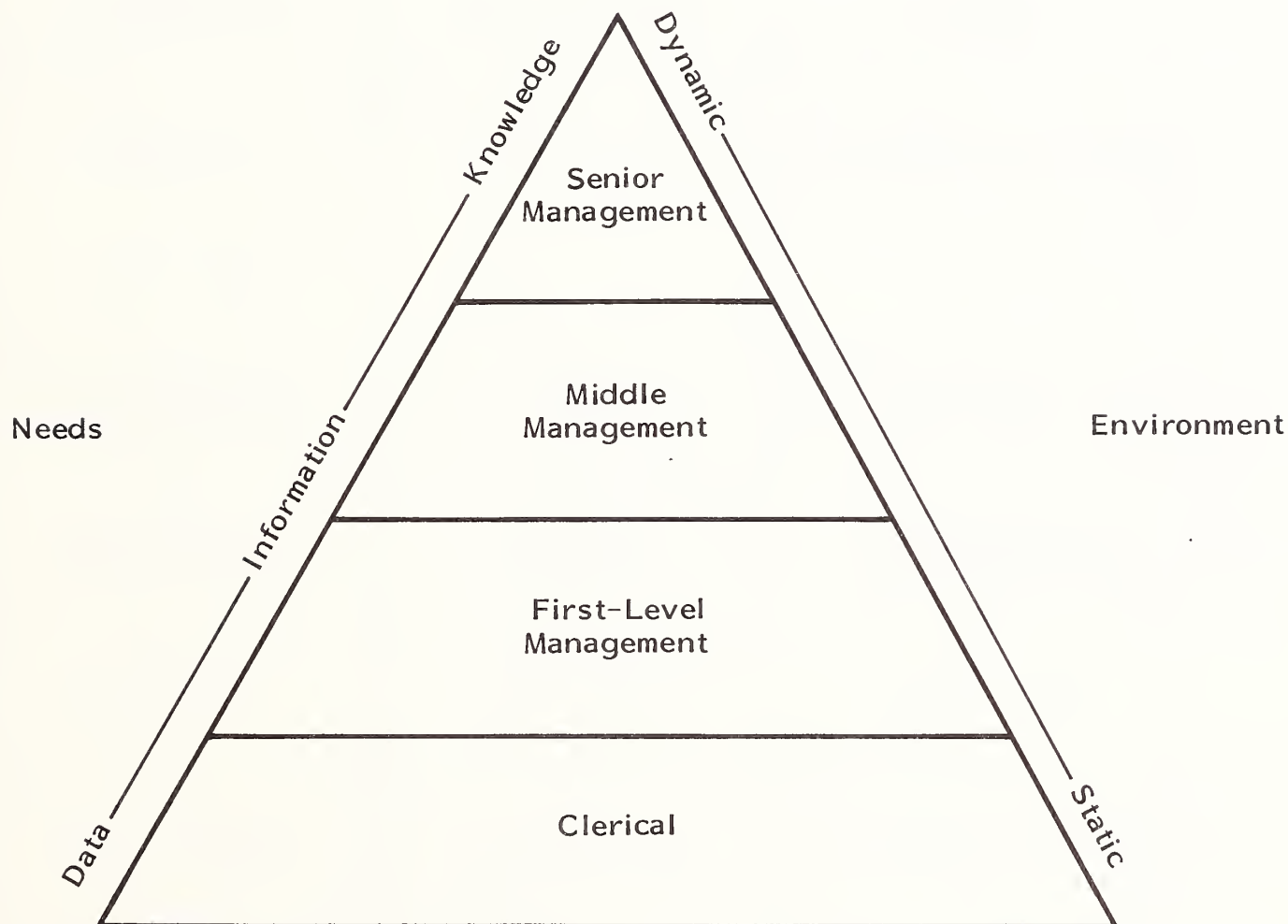
EXHIBIT III-3

MAINFRAME DSS PRODUCTS WITH MICRO VERSIONS

VENDOR	MAINFRAME DSS PRODUCT	MICRO DSS PRODUCT
Applied Data Research	ADR/Empire	PC Empire
Comshare	System "W"	Micro "W"
Execucom	IFPS	IFPS/Personal
Management Decision Systems	Express	Express Mate
Ross Systems	MAPS/Model	MAPS/Model
Segra International	CPL-TACTIX	CPL-TACTIX

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requires access to corporate-wide data bases and, in some instances, external public data bases. This requirement for data to be selected and moved form the mainframe to the personal computers is a major issue facing IS management and a main reason behind the research for the micro-mainframe reports.

3.   SUPPORTING THE WORK GROUPS

- INPUT believes the biggest surge in micro-mainframe link activity will stem from the integration of the micro into corporate operational production systems as mentioned above in stage six of microcomputer usage in business. The microcomputer applications will go beyond those functions associated with decision support and will be more directed at the basic functions of running the business.

- "Work groups" could be the customer service representatives of an insurance company who require access to policy rating data and claims coverage information. The rating tables and formulas, and customer coverage information could be extracted from the host mainframe system for each branch or region and downloaded to the microcomputer in the specific areas. Most of the processing for new policies, policy changes and claims could be handled by the microcomputers and periodically uploaded to the host mainframe.

- Other work groups might be comprised of managers of retail chains who require some autonomy in the planning, controlling, and directing functions of managing their piece of the corporate business, but who also are required to account for their units' performance through corporate data processing. The microcomputer is capable of providing the necessary computing power to satisfy the information needs of local management and also exchange pertinent data with a corporate host mainframe.

- Work groups could be loan teams in a bank, or an order entry department, or the purchasing department, or an inventory control unit. Any homogenous group of workers that is engaged in gathering, processing, or disseminating

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INPUT

information could benefit by employing the capabilities of the microcomputer and its link to the host mainframe.

- As depicted in Exhibit III-4, INPUT believes the inclusion of the microcomputer in future systems architecture will have to be planned by the systems designers. The microcomputer will be required to perform specific functions integral to the production objectives of the enterprise, but will also provide personal computing power to the individual work groups for managerial support activities. Making this happen in a planned and orderly manner is IS's next major challenge.

4. DISTRIBUTED INFORMATION TECHNOLOGY

- There are an increasing number of products being released that support the integration of office automation, distributed data processing, and personal computing functions. There is also more collaboration activity between vendors to make all the information technology connectable and accessible to IBM's mainframe systems.

- The heart of this latest innovation in computing, which has not yet received an acceptable standard title, is the departmental processor. Special purpose departmental processors or small business systems have, heretofore, been the domain of vendors such as Wang Labs, Hewlett-Packard, Data General, and Digital Equipment Corporation. IBM has competed in the small business market with its System/34/36/38 series, but has entered the office automation market in a piecemeal fashion with either standalone units such as the 5520, 8100, and Displaywriter or with its VM/370-based Professional Office Systems (PROFS) and its MVS/370-DOS/VSE-based Distributed Office Support System (DISOSS).

- IBM is positioning the System/36 as its missing link in an integrated office systems network with full information interchange among users, or as one of the leading office systems contenders, Data General, refers to it, compre-

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EXHIBIT III-4

DESIGNING A MICRO-BASED INFORMATION SYSTEM
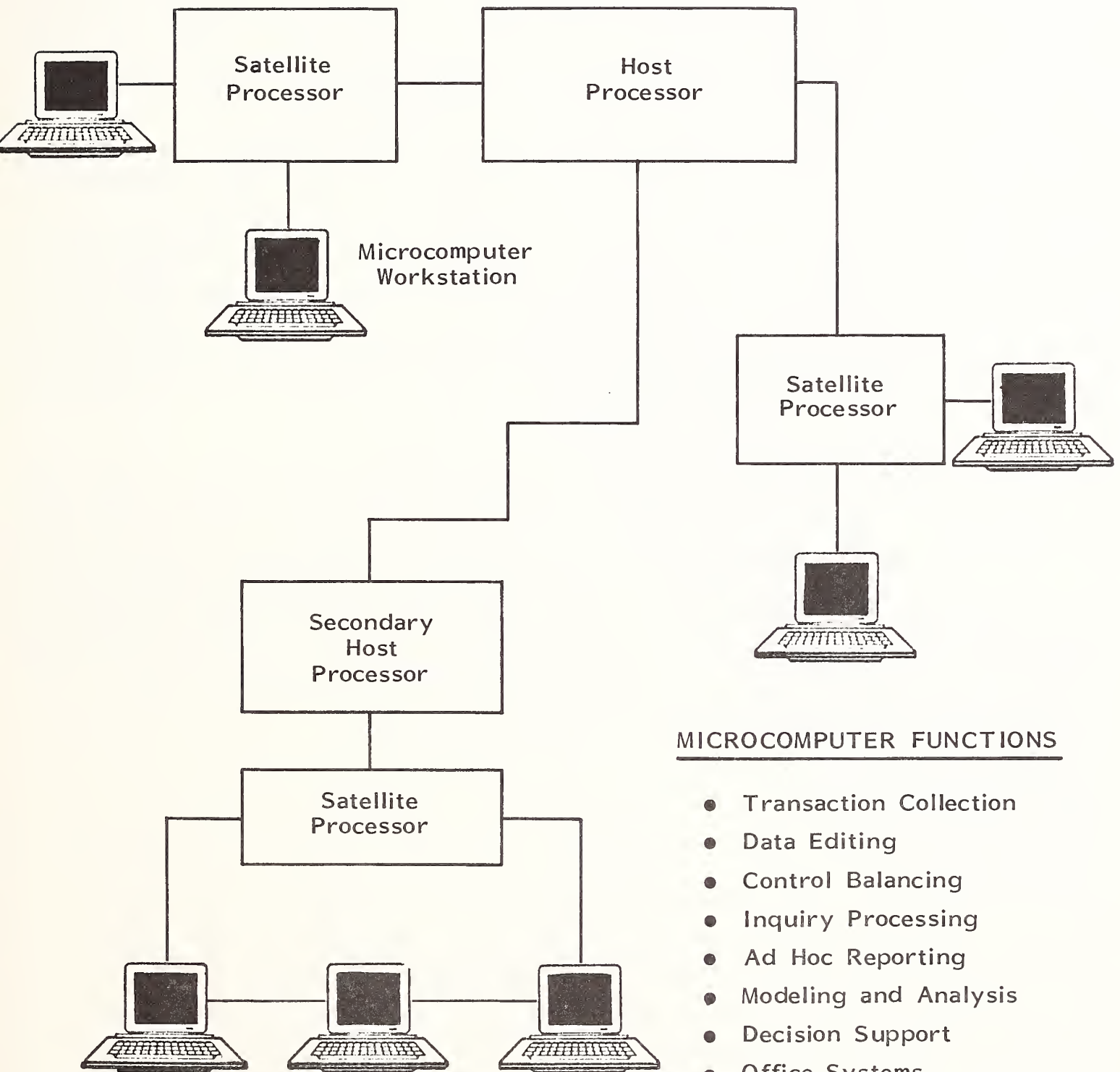
MICROCOMPUTER FUNCTIONS

- Transaction Collection
- Data Editing
- Control Balancing
- Inquiry Processing
- Ad Hoc Reporting
- Modeling and Analysis
- Decision Support
- Office Systems

hensive business automation. Chapter V will take a closer look at the technology issues in this area.

- The microcomputer has been the catalyst behind this movement toward the integration of office automation, distributed data processing, and personal computing. It certainly didn't start out as an integrated link in the corporate computing chain, but the demands of the end users for data access and improved office productivity tools, along with the response from the vendors, has expanded the scope and purpose of micro-mainframe links.

- It is INPUT's impression that IS has been the last to explore the opportunities created by the microcomputer. In defense of IS, however, INPUT believes that IS recognizes the monumental task and cost of converting the existing, predominantly centralized information systems to distributed departmental/work group systems. INPUT further believes that the transition will be evolutionary rather than revolutionary and will not be fully realized until the mid-1990s.

- As shown in Exhibit III-5, the survey data for this study verifies the fact that today's information systems environment is predominantly centralized, but moving toward a more distributed environment through the capabilities of the microcomputer. IS is the only entity with the experience and expertise to bring about a major change in business automation. To do this, IS must look beyond the immediate demands for micro-mainframe links to be certain that today's decisions will fit into tomorrow's situations.

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EXHIBIT III-5

M-M IS SHIFTING I.S. TOWARD DECENTRALIZATION

No Impact
Extreme
Centralization

Great Impact
Extreme
Decentralization

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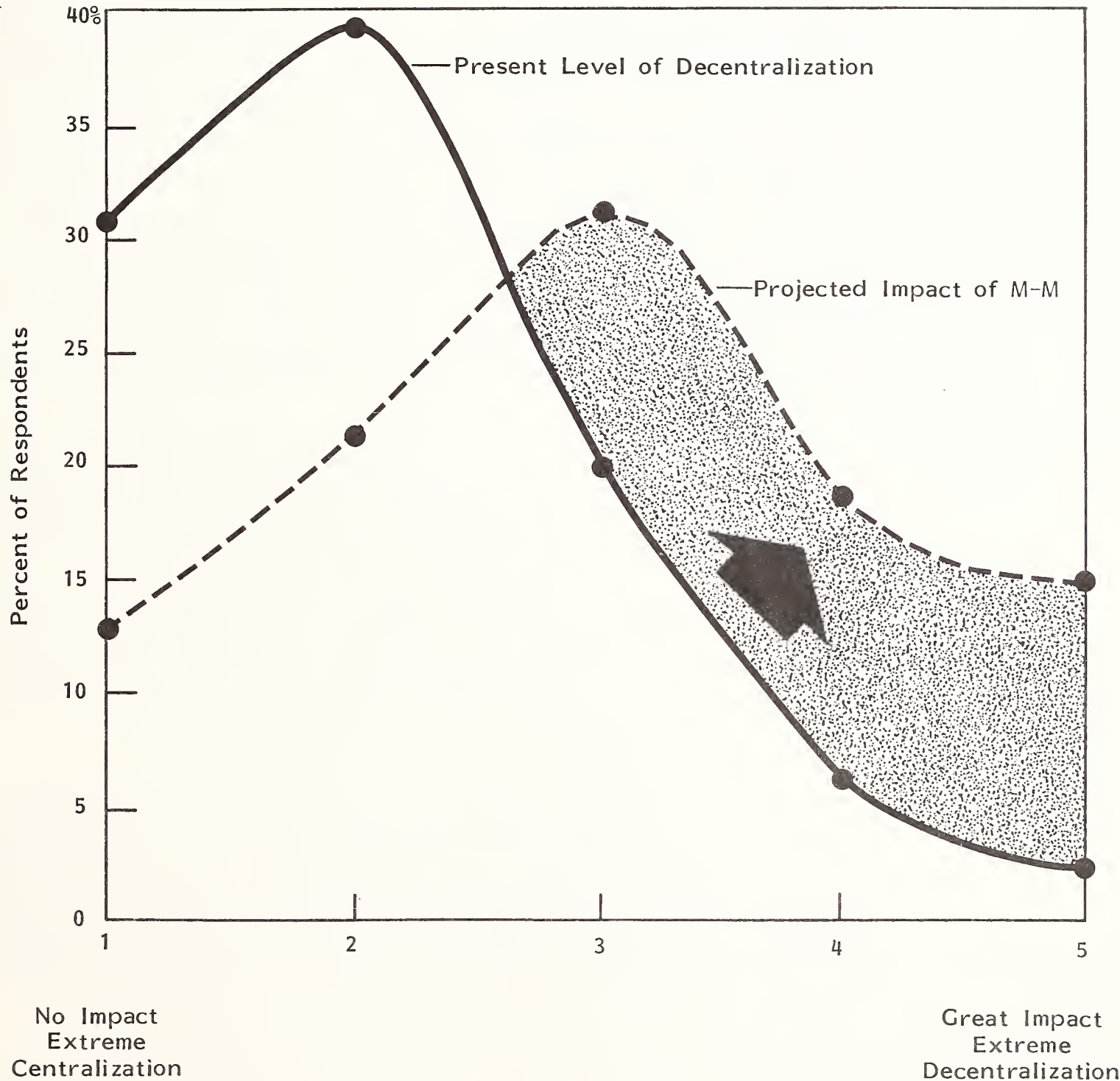
B.   MAKING THE MICRO-MAINFRAME MARRIAGE WORK

I.   ESTABLISHING THE MICRO-MAINFRAME OBJECTIVES

- Exhibit III-6 shows what IS departments believe are the most suitable micro-mainframe applications. Not surprising was the fact that financial analysis (spreadsheets) came out on top, followed closely behind by a more broad category of end-user computing requirements and decision support systems. What was surprising to INPUT was that the majority of the respondents claimed to have these systems implemented. The respondents did not say at what stage these micro-mainframe applications were--file download, selection and extracts from various data bases, or bidirectional upload and download, etc. In other words, just how sophisticated are the existing links? INPUT suspects that the majority are simple links to satisfy the demands of a few, more aggressive end users. This suspicion is based on the relatively low activity in the overall micro-mainframe market and the fact the respondents reported only 17% of their micro base was connected directly to a mainframe.

- In the report <u>The Destiny of the Information Center</u> INPUT stresses the importance of encouraging more collaboration between the end-user support group and the production systems development group. The point being that in order to exploit the capabilities of the microcomputer, IS must look for ways to integrate it into future production systems. To keep merely responding to each end-user's request for mainframe maintained data with a simple terminal emulation link, with little or no regard for cost justification or the impact on resources, could result in chaos.

- IS management should set up a two or three day brainstorming session to arrive at the most plausible and beneficial information services environment for the integration of office automation, end-user computing, and data processing. The results of these sessions should provide the conceptual framework to which each manager could base his or her individual section's

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EXHIBIT III-6

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MOST SUITABLE MICRO-MAINFRAME
APPLICATIONS AS PERCEIVED BY I.S.

- Financial Analysis

- Sales/Marketing Analysis

- Human Resource Benefits Analysis

- Office Automation

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plans. The following functions should be represented at these brainstorming sessions to be certain that each major area is represented:

- Systems development.

- End-user computing support.

- Office automation support.

- Communications.

- Technical support.

- Data center operations.

- Training and education.

2. EVALUATING THE MICRO-MAINFRAME PRODUCTS

- Once the information services conceptual environment is established, criteria for the selection of micro-mainframe linkage software can be identified. The type of users that will require access to mainframe maintained data from a microcomputer should first be established.

  - Knowledge Workers. This group could include financial analysts, business planners, and research analysts. They require the most flexible and encompassing data selection and extract capabilities of all the work groups. They use decision support systems with fourth generation languages and need to access information from any source at the lowest level. They do not want to learn the complex commands of a mainframe data base management system.

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- <u>Middle Managers.</u> This group (and the supporting staff) want direct access to data bases for downloading into popular microcomputer software such as dBASE II or III, VisiCalc, Lotus I-2-3, and Framework. Their top priority is to make certain their units are meeting or exceeding performance commitments against established plans. They continually track and analyze transaction statistics and alter plans accordingly.

- <u>Senior Managers.</u> The executives of large organizations usually have neither the time nor inclination to sit in front of a personal computer and develop spreadsheet applications and generate reports and graphs. They ask the questions that cause the other groups to scurry for the corporate data. If they do use a video display terminal of some sort, their requests normally can be satisfied by preformatted inquiry screens.

- <u>Information and Data Handlers.</u> These are the workers that process the daily transactions. They fill orders, pull parts from inventory, purchase material, maintain personnel records, balance the books, etc. Their actions are replicated in the data stored in the corporate data bases. Their actions can also be directed by the computer. If microcomputers are to assist them in carrying out their daily tasks, then they need interactive, bidirectional links to either departmental processors or host mainframes. They do not, however, require indiscriminate access to corporate data as do the knowledge workers.

- Exhibit III-7 provides a summary of the micro-mainframe users' profiles.

- Once the types of potential users have been identified, profile criteria can be established for considering or eliminating micro-mainframe link products. The major factors to be included are:

  - Mainframe operating systems supported.

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EXHIBIT III-7

PROFILE OF TYPES OF MICRO-TO-MAINFRAME USERS

TYPE OF USER	GENERAL APPLICATION	ACCESS REQUIREMENTS	LINKAGE MODE
Knowledge Worker	Decision Support, Strategic Planning	Any Source, Field Content	Download
Middle Management	Performance Analysis, Tactical Planning	Specific Data Bases, Field	Download
Senior Mangement	Status, Trends, Forecasts	Predetermined Foremats	Inquiry Only
Information and Data Handlers	Business Transaction Processing	Specific Data Bases, Field Content	Bidirectional Upload and Download

- Mainframe data bases accessed.

- Level of data accessed.

- Microcomputer file formats supported.

- Asynchronous and/or synchronous communications supported.

- Decision support systems supported.

- Microcomputer models supported.

- Bidirectional data transfer supported.

- Level of security.

- Virtual floppy disk feature.

- Cost for mainframe component.

- Cost for each microcomputer component.

● Along with the above criteria, the amount of resources required to implement a micro-mainframe link on both the microcomputers and mainframe should be identified for each product being considered.

3.   FORECASTING MICRO-MAINFRAME MARKET TRENDS

● The micro-mainframe market is barely three years old and in 1984 was still in a state of confusion and flux. The market leaders in 1984 reached that distinction due primarily to early entry and cannot be considered established leaders. The number of micro-mainframe participants will increase during the

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period between 1985 and 1987, but by the end of the decade the number will level off to a few recongized leaders, primarily involved in joint ventures in creating, distributing, marketing, and maintaining micro-mainframe products.

- Exhibit III-8 shows how the micro-mainframe market is likely to change by 1990. There are already indications that standards are starting to emerge, such as the Data Interchange Format (DIF) and the use of special dictionaries for data base selection and extraction. By the end of the decade INPUT predicts greater micro-mainframe standardization in technology, function, and price.

- In 1985 the primary method for accessing host data is through direct physical linkage between the microcomputer and the mainframe. As the integration of office systems and data processing evolve, the technology will be further developed to allow more access to corporate data from file servers or departmental processors in a LAN or by a modem connect to the host. There will be several different methods available that can be considered for each linkage need.

C. CORPORATE CONTROL OF DEPARTMENTAL INFORMATION PROCESSING

1. COMPUTING POWER EXPANDS OUTWARD

- Advances in technology and open systems architecture have made it possible for large corporations to distribute their computing power and retain central control. The multilevel hierarchy can include a central mainframe at headquarters, compatible smaller regional mainframes and minicomputers and/or microcomputers at the branch office level. Microcomputers can be directly connected to any of the hierarchical systems or through a local area network (LAN).

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EXHIBIT III-8

MICRO-TO-MAINFRAME MARKET TRENDS

	1984	1990
Micro-Mainframe	No Established Leaders	Leaders and Cooperative Agreements
Micro-Mainframe Market	Confusion	Standards
Mode of Operation	Direct Micro-Mainframe Link	Direct Micro-Mainframe Link Modem and LAN Links
Processing	Centralized	Distributed
Information System's (IS) Role	Tools and Programming	Solutions and Training

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- Not only can the operational transaction processing be handled by the distributed hierarchy, but software and industry standards are in the process of being established that will allow the network to exchange voice, text, and images to support all office systems needs (see IBM link strategy in Chapter V).

- Office automation systems have evolved around the concept of dumb terminals in a network to a file server or minicomputer. Services have included word processing, electronic mail, electronic filing, and administrative support such as time management. Some of the more integrated office automation systems, such as those offered by the leading minicomputer vendors, include microcomputers in the network with end-user computing capabilities, such as spreadsheet processing, and financial modeling and analysis. Through Cullinet's Information Database (IDB), the vendors in this area have a window to the data stored at the host mainframe. A review of DG, DEC, and Wang is covered in Chapter V.

2. TRENDS IN SYSTEMS DEVELOPMENT

- Providing the capability of linking a microcomputer to a mainframe will have an impact on future systems development. This will become evident in three major areas:

  - Applications packages.

  - Prototyping.

  - User developed systems.

- Applications packages for financial accounting, manufacturing, and human resource management have been widely used for many years. Recently, some of the vendors of these products have included generators within their packages to facilitate customization. If these generators are made available

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to the microcomputer users, enhancements to the package could be made by the end users through a high-level parameter-driven language on their microcomputer linked to the mainframe.

- By installing a micro-mainframe link and a microcomputer version of a mainframe fourth generation language, systems prototyping can be accomplished by an end-user with the support of an IS consultant. The basic functions of the systems can be developed on the microcomuter, including the updating of host data bases. The end user and consultant can continue to expand the microcomputer prototype until the ultimate system is derived.

- End users are discovering ways to improve existing production systems through the capabilities of the microcomputer. In the 1984 study <u>End-User Micro-Mainframe Needs</u>, INPUT presented micro-mainframe case studies involving order entry systems for a specialty chemical manufacturer and a petroleum product producer. Both of these companies had extremely complex centralized order entry systems that had evolved over a ten year period.

    - Very specialized sophisticated data bases had been developed to support order entry.

    - Very complex discount algorithms had evolved over time.

    - End users had difficulty understanding and using the centralized system.

    - The end users presented a proposal to IS that incorporated the PC into the order entry system.

    - IS wanted to investigate micro-mainframe link products to allow the integration of the PC with the existing mainframe production system.

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- This is an example of how the end users will become more involved in finding solutions to their information systems problems.

- Data collection and management information reporting will be relegated to the microcomputer in the design of many future systems. By allowing the end users to access corporate data from a microcomputer, they will have the flexibility to satisfy requests for a variety of information formats, especially the ad hoc category.

3. THE EMERGING I.S. ROLE

- The above examples of the trends in systems development indicate a move toward offloading pieces of the systems life cycle onto the end users and the microcomputers. As more systems work is relegated to the end users with microcomputer workstations connected to corporatewide networks, IS's role as a consulting entity will continue to grow.

- In a decentralized systems development environment where end users become more directly involved in the design and implementation process, IS's primary functions will be consultation, training, and technical assistance. In this environment, IS will still have overall authority for strategic information resource planning and will remain the central coordinating function for corporate data management and systems integration.

- IS is becoming a group of highly specialized consultants in the areas of communications, network planning, microcomputer strategies, data management, office systems, and business dynamics.

- Chapter IV will examine how IS should put its expertise to work to provide the greatest payback from the micro-mainframe investment.

IV MICRO-MAINFRAME PLANNING ISSUES

IV MICRO-MAINFRAME PLANNING ISSUES

A. PROBLEMS SOLVED AND PROBLEMS CREATED BY MICRO-TO-MAINFRAME LINKS

- The survey for this study asked the respondents to list, in order of importance, the problems they believe would be solved or alleviated by micro-to-mainframe applications and also the problems that this approach might cause. The results of these inquiries are presented in Exhibits IV-1 and IV-2.

- On the "problems solved" side, availability and accessibility received the most votes, which certainly makes sense. Making data that is stored and maintained by the host mainframe available and accessible to end users, through microcomputers, is what micro-to-mainframe links are all about. This concept of connecting micros to mainframes was brought about by the demands of end users to have data automatically loaded into their micro software packages from mainframe data bases and files.

- Over on the "problems created" side, security and data integrity were by far the top entrants. INPUT has a difficult time understanding why security and data integrity are such a concern to the IS management in regards to micro-to-mainframe links. Any organization that has been developing on-line systems should have a security system in place that provides centralized control of functions and applications that are available to each individual user. Microcomputer users should have to adhere to the same security

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EXHIBIT IV-1

PROBLEMS SOLVED BY MICRO-MAINFRAME APPLICATIONS

SOLVED	INDEX VALUE
Availability/ Accessibility	22
Timeliness	16
Off-Load Main-frame Processing	13
Reduce Applica-tions Backlog	8
Improve End-Use Productivity	7

0   5   10   15   20   25   30

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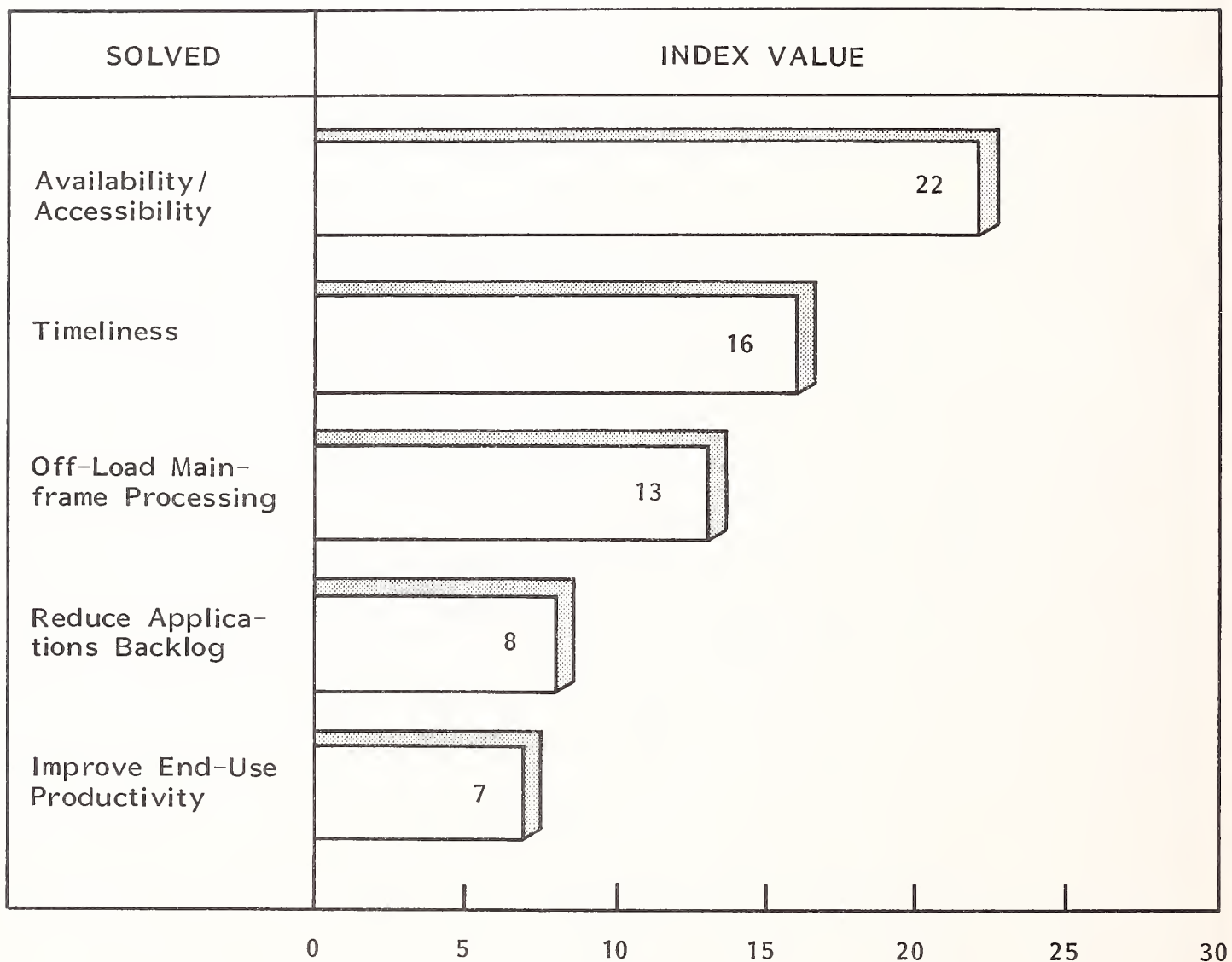
EXHIBIT IV-2

PROBLEMS CREATED BY MICRO-MAINFRAME APPLICATIONS

PROBLEM	INDEX VALUE
Security/ Data Integrity	25
End-User Training/Support	12
Overload Main- frame Processing	7
Link Development	7
Lack of Protocol Standards	7

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0        5       10       15       20       25
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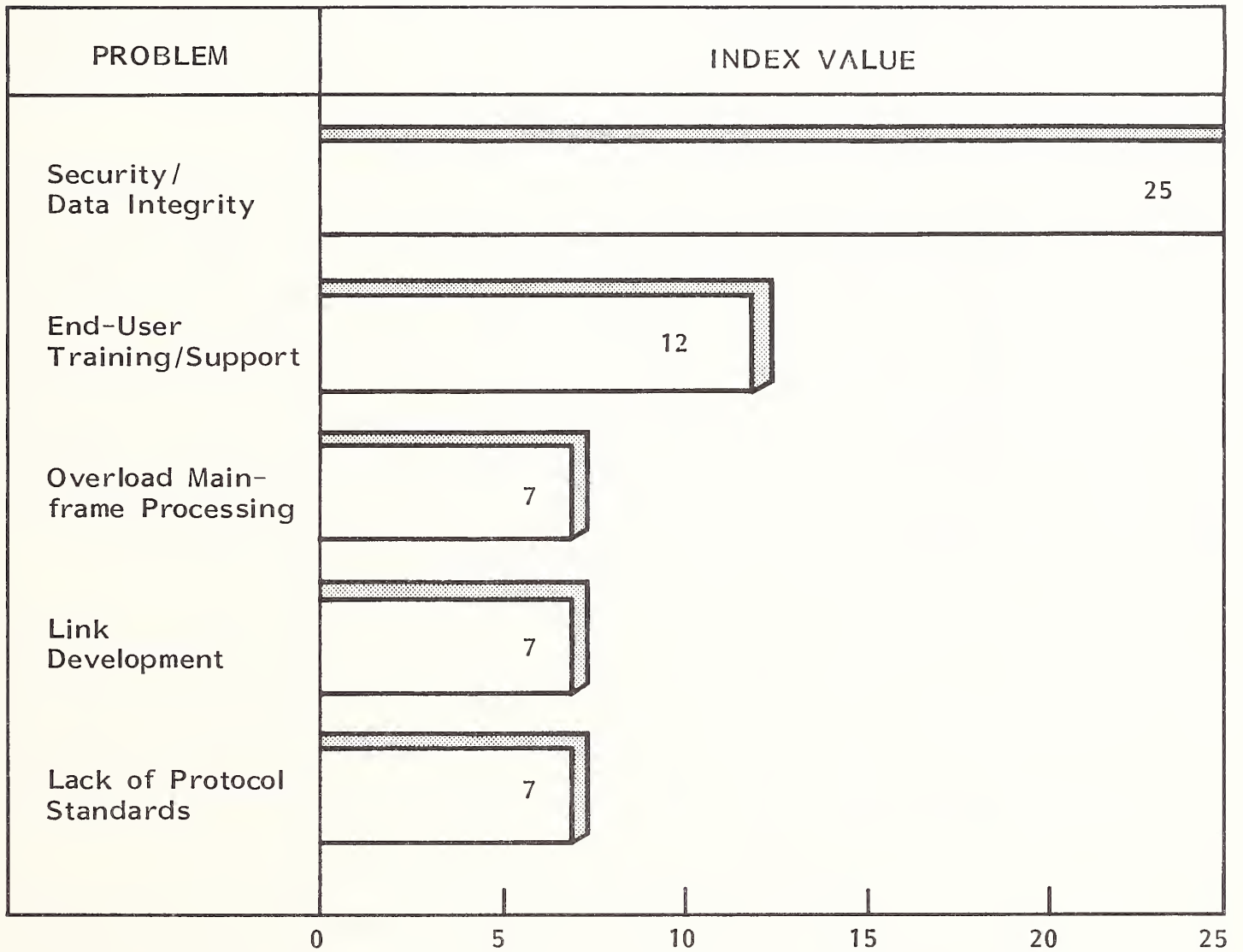
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policies and procedures that govern the video display terminal users. None of the link products reviewed by INPUT allows users indiscriminate access and updating to mainframe data bases and files. The ability to alter mainframe data bases and files from a microcomputer can be controlled by IS in the same manner as terminal users are controlled. The systems design phase will determine if it is desirable to have updating transactions collected or generated by a microcomputer. INPUT believes that IS should be concerned with the physical security of corporate data that has been downloaded to floppy disks. The end users must be made aware of the potential risks of unsecured floppy disks and be held responsible for the corporate data assigned to them. Security risks and procedures can be covered through education.

- "End-user training and support" was the second entry on the problems created list, to which INPUT agrees. The total installed base of microcomputers in all businesses with revenues greater than $10 million is approximately four million units. This figure will more than double by 1989. Nearly all of the four million microcomputers are standalone units, but by 1990 the majority of the 8.6 million will be sharing resources through local area networks, multi-user systems, and micro-mainframe links. Not only will there be millions of new end users to train during the next five years, but the integrated electronic office will require more complex software and more IS support.

- The respondents believe micro-mainframe links will improve the timeliness of the information to the end users primarily because without the link the data to be used by the microcomputer software has to be obtained from hard copy reports, which have to be produced and distributed, and then rekeyed to microcomputer disks.

- The next entries on both the "solved" and "caused" lists are contradictory. There are some IS managers who believe the micro-mainframe applications will offload mainframe processing, and then there is another groups of IS managers who believe the micro-mainframe applications will overload mainframe processing. INPUT happens to believe that both are correct. In the

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beginning of the micro-mainframe evolution the demands of the end users will be the driving force, and IS will respond by providing the linkage tools. As more and more end users access and download mainframe data the possibility of overloading the total system (communications and mainframe) increases. As the micro-mainframe concept matures, IS will integrate the capabilities of the microcomputer into production, transaction driven systems and offload much of the data collection and information report preparation onto the microcomputer. The introduction of departmental processors will further offload the mainframe processing, including office systems.

- Link development was sited as a problem created by micro-mainframe applications, which equates to human resource requirements. Micro-to-mainframe link products will require IS expertise for each application. Security will have to be established, disk space allocated, data base selections made, files constructed, etc. Even the more sophisticated link products will require IS customization.

- As far as reducing applications request backlog, which some IS managers believe the micro-mainframe approach will do, INPUT believes the overall backlog of requests for IS service has probably increased due to the micro-mainframe link. The reason for this position is that IS has always been weak in providing the business user with interactive decision support capabilities. Many financial analysts and market researchers turned to remote computer services vendors to build interactive financial models and perform "what if" analyses, because IS was unable to provide this service. Now with microcomputer decision support software and the ability to tap the corporate data bases, the end users are turning to IS for support, which equates to requests for service and, in turn, generates additional backlog.

- In fifth place on the problems solved list is the thought that micro-mainframe applications will improve end-user productivity. This will only happen if there is some mechanism in place to make certain that frivolous micro-mainframe activity is controlled. For instance, having a multitude of managers all trying

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to solve the same problem presented by some executive at a joint meeting, could prove counter productive. There should be formal micro-to-mainframe procedures that include authorization and security issues. Charge back systems should also be implemented to help control requests.

- Lack of protocol standards was the last entry on the problems created list, which INPUT interprets to mean that linkage software may be more difficult to use because of the lack of protocol standards. The data base management systems vendors cannot be expected to adhere to standards just to accommodate linkage software. This also holds true for the microcomputer software vendors. The data interchange format (DIF) has certainly become a de facto standard in the conversion of mainframe data to popular micro software. IBM's SNA communications protocol has also become a de facto standard to which information services vendors adhere. IBM's DIA/DCA is becoming a de facto standard for moving information around a network. Techniques are emerging that will become standards as the micro-mainframe market matures and settles down to a few alternatives.

B.   IMPACT OF MICRO-TO-MAINFRAME LINKS ON THE I.S. ORGANIZATION

1.   THE NEED FOR DISTRIBUTED SYSTEMS

- IS didn't plan it this way, but the microcomputer is creating a need to consider distributing the information processing resources. As more and more knowledge workers and information handlers are equipped with micro-based workstations, the need to connect these workstations becomes imperative to facilitate data and interpersonal communications.

- A financial analyst, for instance, has a need to tap the corporate data base for up-to-date information on the performance of the organization, but at the same time has a need to communicate with his peers through electronic

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mail. There can also be a need to access public data bases or data bases created by other end users. Exhibit IV-3 illustrates the various sources of data that should be available to the knowledge worker.

- To date, demands for micro-to-mainframe links have been handled by the information center or end-user support group on a per request basis. The volume of requests has been relatively small and hasn't posed any significant mainframe capacity problems. Office automation has been treated as a separate issue and usually found on specialized mini systems or a small mainframe under VM/PROFS.

- It is INPUT's contention that the IS organization should be looking down the road three to five years to anticipate the impact of the growth in automated workstations, which put in another way, means the integration of data processing, office automation and personal computing.

- A centralized mainframe will be unable to handle the communication traffic and data base queries generated by the integrated electronic office of the future. IS (at the senior management level) should be investigating micro-mini-mainframe link technology. Alternate network topographies like the one depicted in Exhibit IV-4 should be evaluated. Superminis might become local-area network file servers and accommodate links to the corporate data maintained on the host mainframe. Chapter V reviews what Wang Laboratories, Data General, and Digital Equipment Corporation are doing to support this move toward integration.

- INPUT asked the respondents to this study for their estimates of the impact that micro-to-mainframe links would have on both the capacity of the current mainframe and disk storage over the next two years. Exhibit IV-5 shows the results of this inquiry. The 17% increase in mainframe capacity and 18% increase in disk storage capacity to handle the micro-mainframe link activity, are average percentages of all respondents. Thirty percent of the sample, projects closer to a 30% increase in mainframe capacity required to accom-

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EXHIBIT IV-3

INTEGRATING THE MICROCOMPUTER

Office
Systems
Information

Corporate
Production
Data Bases

Knowledge Worker
Workstation

Department
Data Bases

Other Micro
Data Bases

External
Data Bases
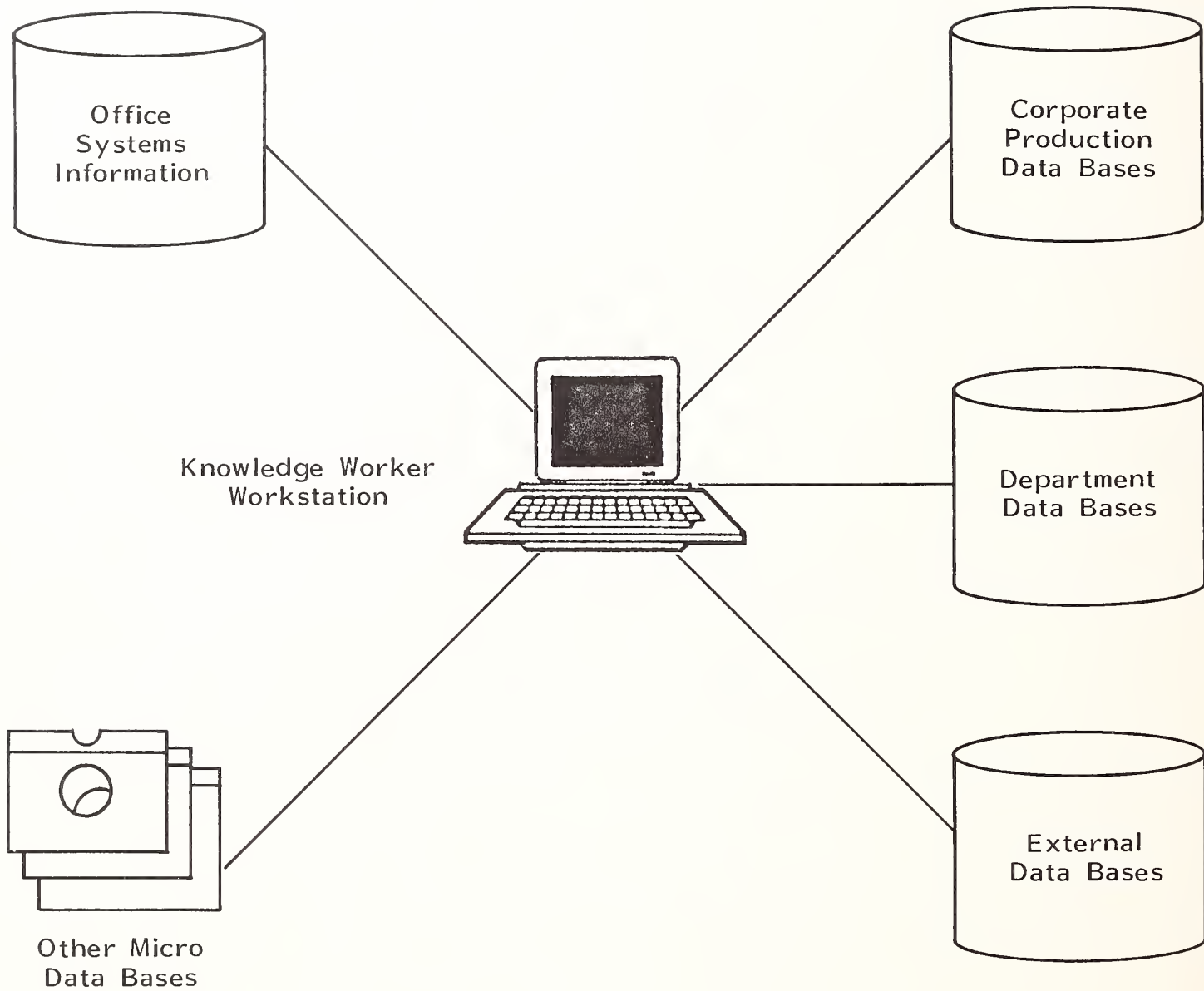
EXHIBIT IV-4

DISTRIBUTED SYSTEMS DIRECTION

(N) PCs . . .

IRMA	IRMA	Terminal
PC	PC	

Terminal Controller

- Data Processing
- Office Systems
- Personal Computing
- MF Link Software

Minicomputer or Small Mainframe

Printer

Departmental Production Data Bases

Personal Computing Data Bases

Modem

SNA/SDLC DIA/DCA

Modem

- DISOSS
- Data Processing (Integration)
- Link SW

Host Mainframe

Corporate Production Volume 1

Production Volume 2

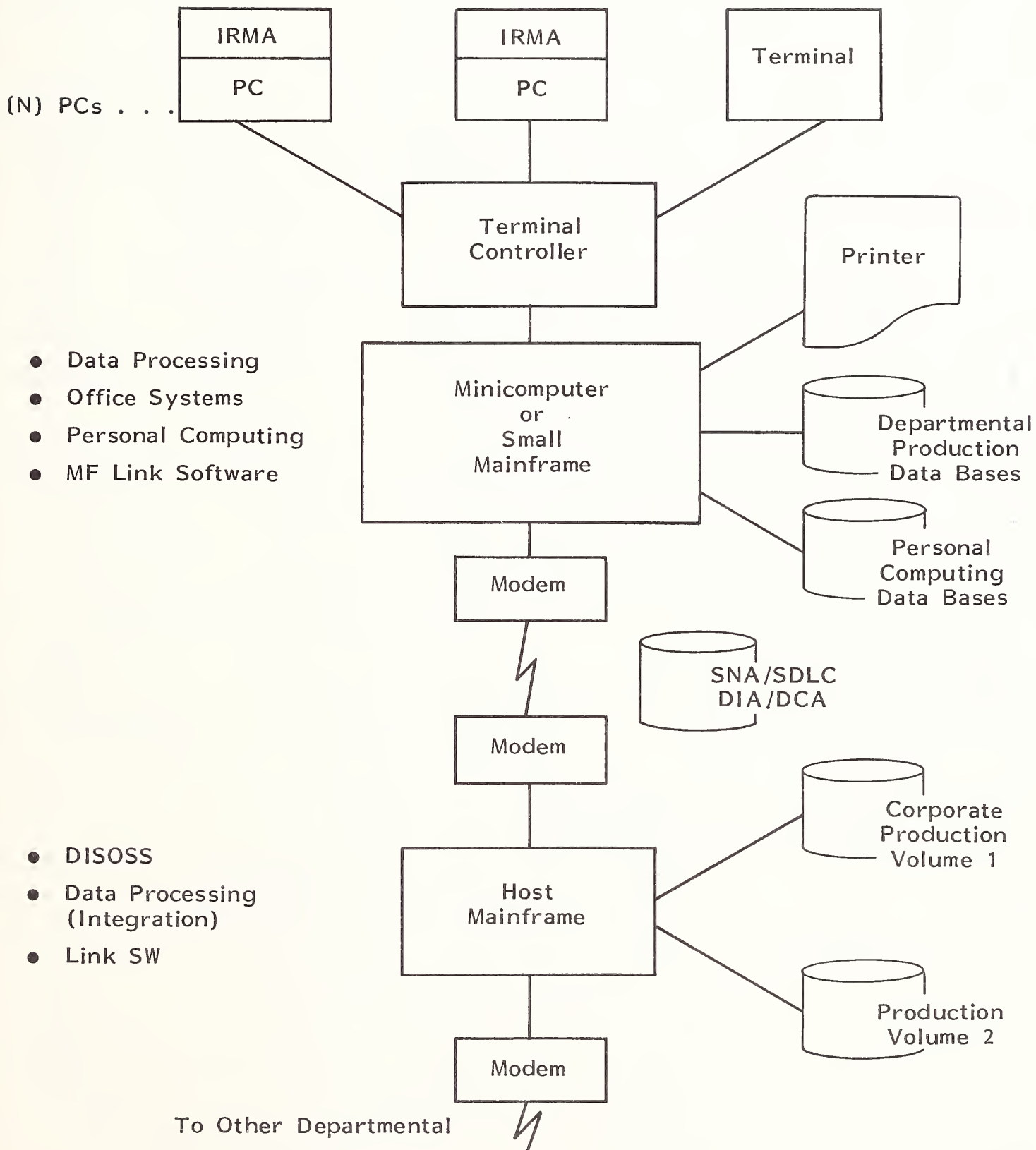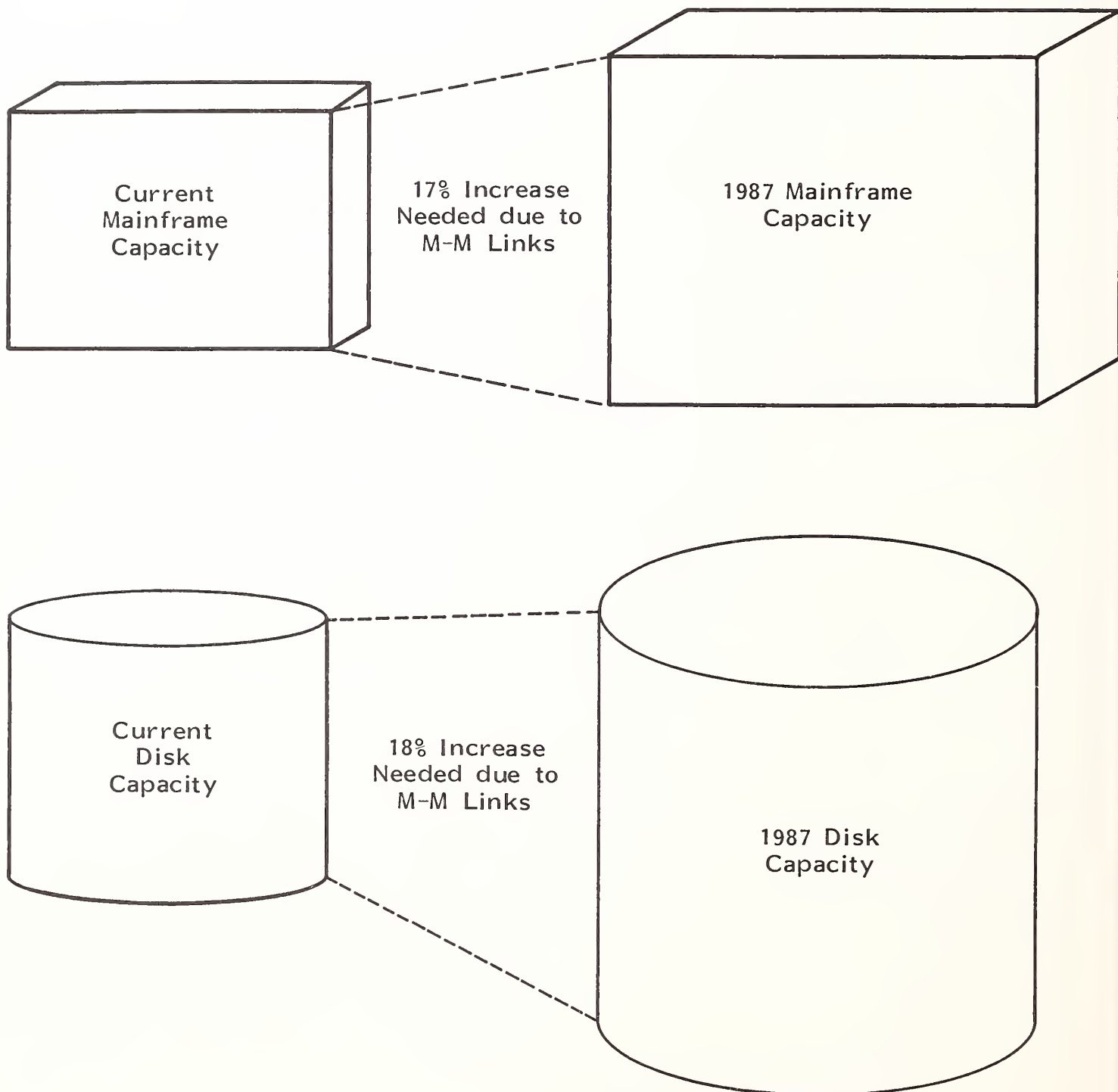Modem

To Other Departmental

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EXHIBIT IV-5

AVERAGE PROJECTED IMPACT OF M-M APPLICATIONS
ON MAINFRAME PROCESSING AND DISK STORAGE DEMANDS

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modate the link activity. The projected growth is in anticipation of the increase of end users requesting access to the corporate data maintained in host data bases. Many of micro-mainframe products employ the virtual floppy disk concept, which will add to the mainframe disk storage requirements. These statistics add credence to INPUT's recommendation to investigate micro-mini-mainframe link technology.

2.   THE CHANGING STRUCTURE OF I.S.

•   Along with the evaluation of alternate network topographies as recommended above, IS should also determine the most efficient organizational structure to fit the future computing environment. INPUT's report The Destiny of the Information Center states that IS management is inadvertently creating new empires within the IS structure by handing over the responsibilities for all end-user computing initiatives to the information center manager. These responsibilities can include:

    -    Microcomputer hardware and software selections.

    -    Information center mainframe software selection.

    -    Office systems planning and implementation.

    -    End-user training.

    -    Local area network planning.

    -    Micro-mainframe link planning and implementation.

    -    End-user computing standards.

    -    Decision support systems development.

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- The information center or end-user support group is the fastest growing unit within IS. Many of these groups are looking to double their staffs over the next two years to keep up with the increasing demands. INPUT sanctions the establishment of a strong end-user computing support group, especially during this evolutionary period, when concepts and products are unsettled and directions are unclear.

- If IS is considering the installation of processors at the departmental level to accommodate office systems activity and data service for end-user computing, then it should be investigating organizational structures that will accommodate future systems development in this new environment.

- INPUT believes that as data processing, end-user computing, and office automation move toward integration there will be a need to merge the end-user support function into the systems development function. Office automation and end-user computing cannot continue down a separate path from the traditional production systems development function. If the separation is allowed to continue there is a risk of incompatible redundant systems emerging. As the micro-mini-mainframe link technology becomes more sophisticated and provides interactive shared functionality on a peer-to-peer basis, the end users will have the ability to develop comprehensive transaction driven systems that are capable of updating corporate data bases either directly or through minicomputer file servers from the microcomputer workstations.

- The capabilities of the microcomputers and the minicomputers must be taken into consideration in the design phase of future systems. For this reason INPUT is suggesting that end-user computing support and production systems development both be assigned to a single corporate systems development manager, as depicted in Exhibit IV-6. In a distributed information systems environment, departments could have their own minicomputers or small mainframes tied into the corporate data center through communications networks and linkage software. These distributed IS functions could maintain their own systems development staffs to service the local requirements for

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EXHIBIT IV-6

I.S. ORGANIZATION IN AN INTEGRATED OFFICE SYSTEMS ENVIRONMENT

Corporate Information Systems Officer

- **Education and Training**
  - IS Entry Level
  - Management Education
  - Systems Software Education
  - End-User Training
  - Media-Based Training Coordination

- **Corporate Systems Development**

- **Technical Support**
  - Systems Software
  - Communications

- **Corporate Data Center**

- **End-User Support**
  - Information Center
  - Office Systems Coordination
  - Microcomputer Technical Support
  - Consultation
  - Production Systems Liaison

- **Production Systems**
  - Applications Planning
  - Applications Integration
  - Data Management
  - Analysis and Programming
  - Package Selection
  - Quality Assurance
  - End-User Computing Liaison

- **Distributed IS Functions**
  - Departmental Processors
  - Personal Computing
  - Office Automation
  - Distributed Systems Development

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data processing, office automation, and personal computing, and act as liaison with corporate IS. Standards, guidelines, hardware/software selection, acquisitions, and applications integration would remain at the corporate level.

- If not already in place, INPUT is recommending the establishment of a separate training and education department within corporate IS, reporting to the top IS officer. This function would have the responsibility for all IS-related training and education from entry level programming training to end-user computing training. It would develop training and education plans and would select the related training products. With the growth of end-user computing, especially in the area of microcomputers sharing resources through LANs and accessing corporate data bases through linkage software, along with more complex office systems, the need for effective training and education programs becomes more critical. This enormous training task should not be left on the shoulders of the manager of end-user computing support. The end-user support group should assist in the training task, but experienced educators should be providing the direction. There is more on this subject in INPUT's report entitled <u>Training: Prerequisite to End-User Computing.</u>
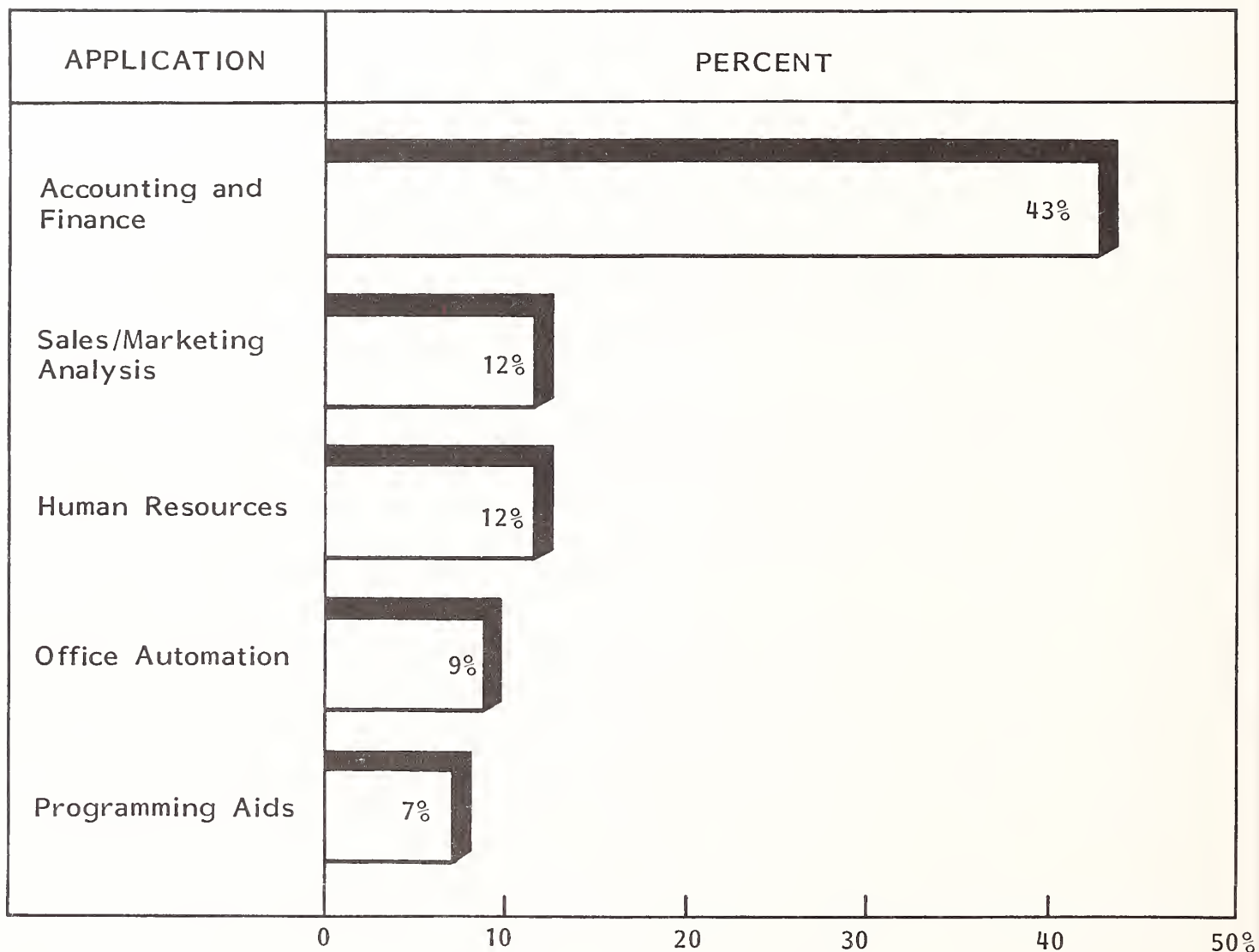
3. PLANNING FOR FUTURE SYSTEMS DEVELOPMENT

- Whenever new technologies are introduced it takes several years before they become common usage across the IS organizations. Companies are still in the process of converting old batch systems to on-line systems. Data base management systems are being installed for the first time in many organizations. The reason for the delay between the time an innovation is announced and the time it becomes widely used, is the investment that has been made in the existing system's architecture. An existing system in insurance, manufacturing, banking, retailing or government, to mention a few industries, could have taken several years to develop and could be close to ten years old. Major modifications have taken place over the years and the system has been converted to new hardware and systems software, but the basic architecture

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is the same. Taking advantage of the power of the microcomputer to improve the benefits of an information system will not happen immediately, even if the ultimate linkage software were available, because it will normally require a total rewrite to replace the existing system.

- The concept of distributed departmental processors will also take several years before becoming an accepted practice because of the difficulty to change from the existing centralized environment. New concepts are risky and seasoned IS managers have learned to wait until the pioneers have uncovered the stumbling blocks before making a commitment.

- The systems designers, however, should be aware of the capabilities of innovations such as the microcomputer, the departmental minicomputer, and the linkage software, so that plans to replace existing major systems can take these capabilities into consideration.

- When INPUT asked the respondents to identify the most suitable micro-to-mainframe applications the application category that, by far, received the most mentions was accounting and finance, as shown in Exhibit IV-7. This category included financial analysis or downloading to spreadsheets.

- The two categories of applications that received the second greatest number of mentions were sales/marketing analysis and human resource analysis. Forecasting sales and market research are both applications that require performance information stored in the mainframe data bases. The human resource applications included analysis of the benefits and compensation programs. In third place for the most suitable micro-to-mainframe applications was office automation, which would give the microcomputer user the ability to exchange documents with users connected to mainframe office automation systems such as DISOSS or VM/PROFS. The final most mentioned application encompasses the use of popular microcomputer software packages, without any specific business area mentioned. These packages could include fourth generation languages, data base management systems, and graphics software.

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EXHIBIT IV-7

MICRO-MAINFRAME APPLICATIONS
(Percent of Respondent Mentions)

APPLICATION	PERCENT
Accounting and Finance	43%
Sales/Marketing Analysis	12%
Human Resources	12%
Office Automation	9%
Programming Aids	7%

0   10   20   30   40   50%

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- All in all, downloading mainframe-maintained data to the microcomputer for some sort of analysis is perceived as being the most suitable micro-to-mainframe applications. Very few respondents envisioned the microcomputer as an integral part of the future production systems, which INPUT is predicting will be the wave of the future. This lack of interest in applying microcomputer capabilities to production systems is due to the present orientation and driving force. The requests for downloading corporate data to the microcomputers is being initiated by the end users and satisfied by the end-users support group. Once the systems developers start to exploit the microcomputer this orientation will swing toward production systems.

C. DEVELOPING A MICRO-TO-MAINFRAME PLAN
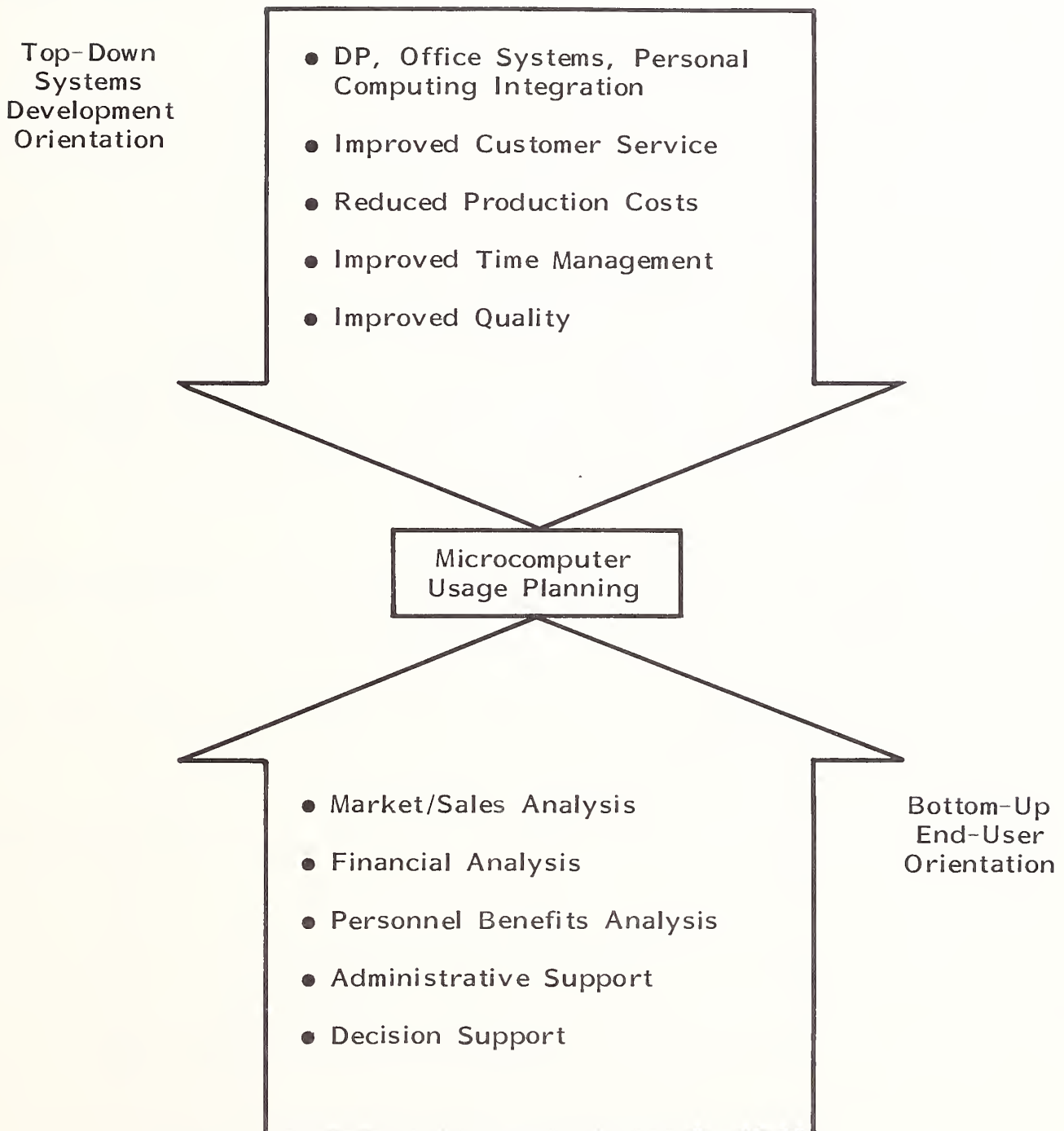
1. TOP-DOWN VERSUS BOTTOM-UP ORIENTATION

- The use of microcomputers in corporations was not initiated by IS, but rather by the end users themselves. This is an unusual situation because normally IS management spends a considerable amount of time selling the concepts of new technologies. Convincing senior management of the benefits of an innovation in information systems has been a primary task for IS. The IS organization has been refered to as the agent of change. In the case of the microcomputer, however, IS not only didn't have to sell the idea, but had to curb the phenomenal proliferation of these devices to bring order to the impending chaos.

- IS has gained control of the acquisitions of microcomputers by publishing compatibility standards and lists of approved and supported software packages. IS has set up the hot-line service to provide phone consultation to the microcomputer users, and IS has assumed the responsibility of training the end users on how to use and apply these new devices. IS has been in a supportive role on issues pertaining to the use of microcomputers; in fact, special groups

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have been formed within IS specifically to support end users in their computing endeavors.

- The installation of micro-mainframe links has also been in response to the demands of the end users for direct access to corporate mainframe data bases and files. The end users have been the driving force behind the exploitation of the microcomputer. The IS systems designers have not yet realized the potential benefits of integrating the capabilities of the microcomputer into the architecture of production systems.

- INPUT believes that in order to take full advantage of the power of the microcomputer IS must explore the possibilities of using the microcomputer for more than analysis and decision support activities. The microcomputer is capable of processing transactions and producing action documents and accounting reports. It can also act as an office systems workstation and tie into a corporatewide communications network.

- The bottom-up planning for microcomputer usage will continue, because end users will keep finding new applications for the microcomputer, and the end-user support group within IS will continue to respond to the needs of the end users. Along with this bottom-up orientation there must also be a top-down planning activity that is investigating ways the microcompter can further help a corporation meet its overall goals and objectives. This concept is illustrated in Exhibit IV-8. The top-down planning should be initiated by the IS systems development function rather than the information center or end-user support group.

- Task forces can be established for identifying areas of opportunities for microcomputer usage. The membership should have representatives from the information center or end-user support group and the operational business units of the corporation. The task force leaders, however, should be from the senior systems analyst ranks because of their overall knowledge of the information systems requirements of the corporation.

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EXHIBIT IV-8

TOP-DOWN VERSUS BOTTOM-UP
MICROCOMPUTER USAGE PLANNING

Top-Down
Systems
Development
Orientation

- DP, Office Systems, Personal Computing Integration

- Improved Customer Service

- Reduced Production Costs

- Improved Time Management

- Improved Quality

Microcomputer
Usage Planning

- Market/Sales Analysis

- Financial Analysis

- Personnel Benefits Analysis

- Administrative Support

- Decision Support

Bottom-Up
End-User
Orientation

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2.   STEPS FOR SELECTING THE RIGHT LINKAGE PRODUCTS

● Once the opportunities for microcomputer usage have been identified from both a top-down and bottom-up view, and distributed systems topographies have been conceptualized, then linkage software and hardware products can be selected.

● If linkage products are available that can accommodate the strategic plan for microcomputer usage and also handle the current requests from end users for data base access, then these products should be pursued. The costs for such linkage products can be justified by the potential number of users and applications. The justification can be based on the economy of scale, where the cost can be spread over the total number of users that will be serviced by the products and represented as a cost per user. The task force should present the cost justification figures to the IS Steering Committe (or equivilent). As the applications are implemented, existing charge-back systems should be employed.

● Regardless of the microcomputer application, there are basic criteria that linkage products must meet before being considered:

    - Compatible with the mainframe hardware and operating systems environment.

    - Supports installed and planned microcomputer models and operating systems.

    - Supports host teleprocessing monitor system.

    - Supports installed and planned microcomputer file formats.

    - Supports the various host data management systems being used.

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- Supports the existing host security system.

- Supports field selection level.

- Alternatives should also be rated on the amount of technical support effort that will be required to satisfy each link application. Linkage software that is highly integrated with specific proprietary packages may be easier to install and easier for the end users to operate, but may be incapable of functioning with other installed applications.

- It is probable that more than one linkage alternative will have to be considered. A simple file transfer link might satisfy the bulk of requests from end users for mainframe data downloading, but an intelligent link, capable of extracting and updating fields of data stored in various mainframe data bases or files, may be required for interactive production systems.

- Exhibit IV-9 summarizes the steps to follow in obtaining and installing linkage software. Micro-to-mainframe link concepts should also be considered for systems other than those which strictly support end-user computing needs, and therefore the planning must involve the systems developers. The use of departmental processors and/or file servers should be evaluated and probable network topographies identified. Considering a distributed environment and the data processing and office systems requirements, potential microcomputer applications should be able to be uncovered. Looking at the present and future information systems environments, criteria for the selection of linkage products should be established. Potential micro-to-mainframe linkage products that fit the criteria and the environments can then be identified. The number of potential users of the product(s) should also be identified to provide the economy of scale cost justification figures. The findings should be presented to senior management for approval. Pilot links should be installed to provide a controlled evaluation environment. Once the test period is past, additional end users and/or applications can be considered for linkage support.

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EXHIBIT IV-9

STEPS FOR MICRO-MAINFRAME LINK INSTALLATION

- Involve Systems Developers

- Evaluate Distributed Environments

- Identify Potential Microcomputer Applications

- Establish M-M Link Criteria

- Identify Potential M-M Products

- Identify Potential Number of Users

- Select M-M Product(s)

- Obtain Approval from IS Steering Committee

- Install and Evaluate Pilot

- Add Users and/or Applications

- Install Additional M-M Products as Required

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- The above represents the steps that should be taken before investing in costly micro-mainframe link products. Until these strategic plans can be developed, requests for data downloading should be satisfied through simple terminal emulation and file transfer products to keep the investment at a minimum.

D.   LONG-TERM BENEFITS OF THE MICRO-TO-MAINFRAME CONCEPT

- In spite of IS, the advent of the microcomputer is having a significant impact on corporate business systems. The vendors have siezed the opportunities to market microcomputer products aimed at the end-user decision support needs. IS has assumed a supportive role and is helping the end users select and implement these products. The micro-to-mainframe links are being installed by IS to further support the microcomputer users in the decision support area.

- INPUT is predicting that the microcomputer will be the strategic device for the future integrated office systems environment. It will be an integral part of, and play an important role in, future information applications and office automation systems. The microcomputer will eventually take over some of the processing load from the mainframe and will help reduce the IS request backlog. Through the microcomputer technology, the end users will become more directly involved in developing future systems and future systems will be designed around the microcomputer capabilities.

- The full potential of the microcomputer can only be realized through links. The links will take many forms, including local area networks, micro-mini links, and micro-mainframe links. The term micro-to-mainframe has come to encompass all of the micro link possibilities that enables end users access to the host mainframe data bases and files, and full information interchange with other end users on the network.

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- Progressing from a simple file downloading orientation to an integrated office systems environment will not materialize without the collaborative planning efforts of the end-user support group, the systems development group, and the key end users. The long-term benefits of micro-to-mainframe concepts will be realized by uncovering potential applications from a strategic corporate view. This can only be achieved through thoughtful planning.

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V   MICRO-MAINFRAME TRENDS

- As Exhibit V-1 indicates, the respondents to this study believe there is no doubt about the fact that between 1985 and 1987 there will be a tremendous move toward linking the microcomputers to the mainframes. This response survey stems from the demands of the end users for access to the production data maintained by the mainframe, rather than by IS's initiative. IS must establish where this latest innovation is headed and set its sights on how IS will be servicing the corporation in the future. This chapter examines some of the pertinent trends that IS must consider in the overall micro-to-mainframe planning.

A.   IBM'S LINK STRATEGIES

1.   GENERAL DIRECTION

- IBM's business planners apparently did not anticipate how quickly the integration of office automation, personal computing, and data processing would evolve, and how quickly the competition (DG, DEC, and Wang) would respond to this need. IBM has relied on centralized control of information processing resources through SNA/MVS/CMS VM/TSO mainframe operating environments.

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EXHIBIT V-1

M-M CONNECTIVITY BY PERCENT OF TOTAL MICROS
SURVEY RESULTS

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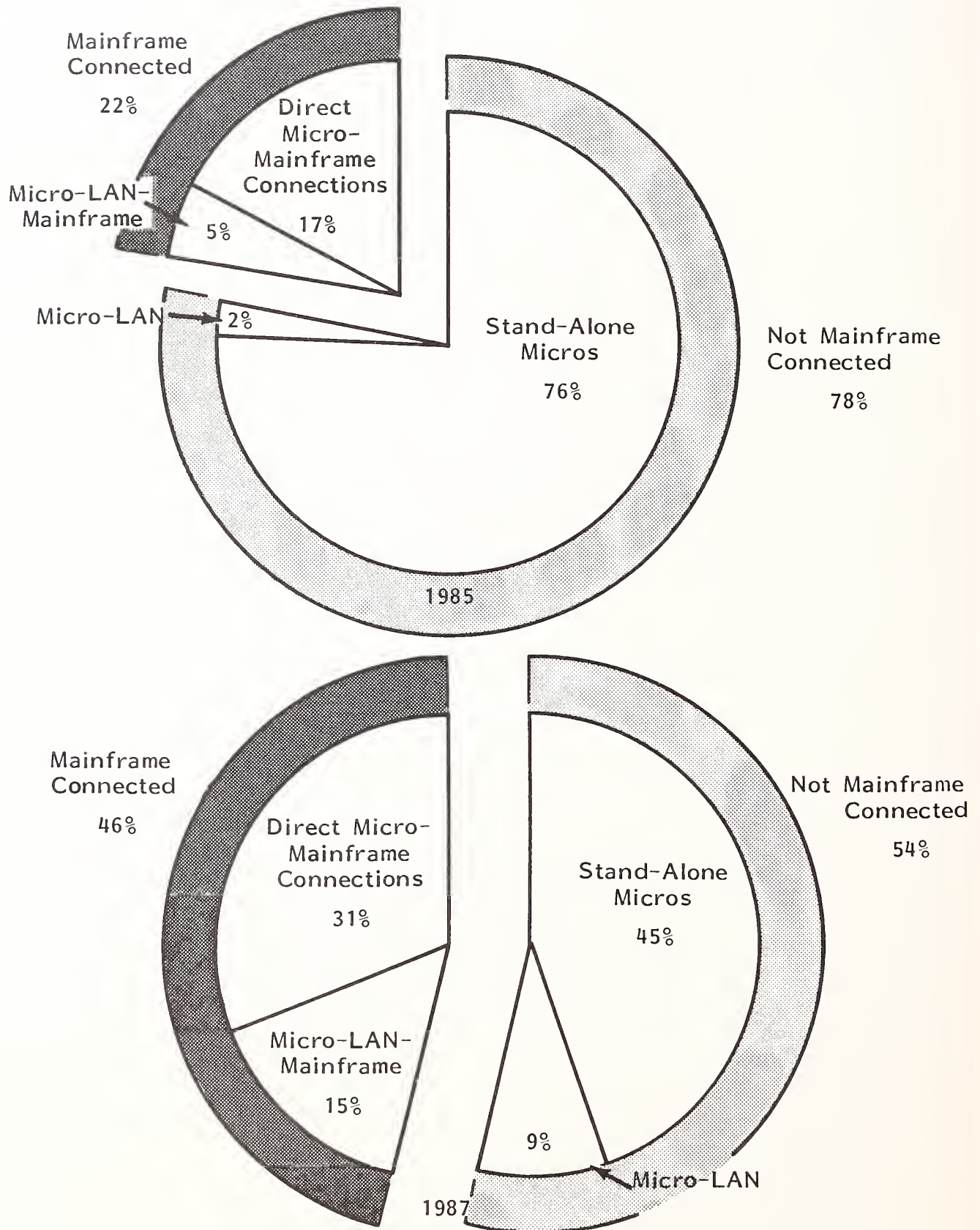
- IBM was late getting into the personal computer business, and even though the PC line has been a tremendous success, IBM is still suffering the effects of lagging behind in PC software support. Companies such as Lotus Development and Ashton-Tate have a stronghold on the personal computer software market, and IBM may have a difficult job developing PC-mainframe link solutions that preclude the use of installed third-party software.

- Historically, IBM's office systems have been fragmented between the data processing and office systems groups, and in the past the two were vying for the same business. Up until recently, IBM has seen no value in providing links among the 8100, the 5520 Administrative System, Displaywriter, the VM/370-based Professional Office System (PROFS), and the MVS/370-DOS/VSE-based Distributed Office Support System (DISOSS).

- The demands for document and data interchange among office systems, including personal computing, and the position of the competition has forced IBM to put together an integrated approach using existing hardware and software components as the foundation. The three hardware pieces selected by IBM to vie for the departmental/office environment are the System/370 series (370, 43XX, 30XX), the System/36, and the PC AT/370.

2. OFFICE SYSTEMS FAMILY SOFTWARE

- The major pieces of software that IBM has chosen to use to interconnect PCs and System/36 and System/370 are:

  - Data Edition, a module of the Personal Decision Series of software products for the personal computers. This would handles data management, query, sorting, and calculation. It also provides interfaces to IBM's Business Management Series and DIF file conversion.

  - Attachment/36 and 370/Edition are the linkage software that resides on both the PCs and hosts. They are designed to provide transparent

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data transfers and format conversions. Both the System/36 link and the 370 link offer virtual disk options.

- Personal Services/PC, an application program that allows PC users to exchange text documents, messages and files with System/370 and System/36 hosts by way of a PC Network or communications with a 370/DISOSS host. DISOSS can distribute a PC DCA file to any DCA/DIA supported device.

- PC Displaywrite 3 is IBM's word processing product for PCs that resembles the Textpack 6 software that runs on the dedicated word processor (DisplayWriter). It will help facilitate the exchange of documents between PCs and DISOSS/370 systems.

3. SYSTEMS NETWORK ARCHITECTURE (SNA)

- The communications pieces of IBM's integrated solution, includes SNA and the Distribution Services (SNADS) for network, control, and the Document Interchange Architecture (DIA), which handles the protocols and data structures being transmitted among diversified nodes. DIA provides basically three types of document interchange services:

    - Library services. End users can store and retrieve documents in a central library.

    - Distribution services. End users can send documents or information to one or more locations on the network.

    - Application processing services. End users can invoke document transform routines and execute programs on the host mainframe.

- IBM's Document Content Architecture (DCA) supports the DIA functions in the SNA environment by defining the format of the data, text, images, graphics, or voice being transmitted.

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- Advanced Program to Program Communications (APPC) is an enhancement to SNA that provides the following features required to support IBM's plans to integrate office automation, personal computing, and data processing:

    - Standard application interfaces to the network.

    - Peer-to-peer communications between workstations and hosts.

    - Compatible protocols between all types of workstations.

- APPC introduces two new vital units to SNA: LU 6.2 and PU 2.1. The logical unit LU 6.2 supports communications between distributed application programs and has a standard interface with applications across the entire SNA network. The peer-to-peer communication is provided through the new physical unit PU 2.1, which also supports multiple physical data links to interconnect workstations.

4. PC STRATEGY

- To accommodate the trend toward integration of products, IBM has identified the PC AT/370 as the future corporate personal computer. The 80286 processor is three times faster than the 8088 processor used in the original PC, which allows support of concurrent operations and file sharing capabilities. Under the Microsoft Xenix operating system two dumb ASC II terminals can hook up to the serial port on a single ridged disk AT. With its speed and greater storage capacity the PC AT/370 will fit nicely into an integrated systems architecture.

- The PC Network is a broadband LAN that allows up to 72 users within a 1000-foot radius and represents an interim solution while waiting for IBM's much talked about token-ring LAN. Even though IBM claims that bridges will be provided between the installed PC Networks and the new token passing cabling, it might be less expensive to switch over totally.

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5. DEPARTMENTAL PROCESSORS

- Before rushing out and acquiring a System/36 for each department, which IBM is counting on, there are factors that should be considered:

    - The System/36 architecture, systems software and peripherals, including terminals, are not compatible with the System/370 family (370s, 43XX, 30XXs).

    - The System/36 may not be capable of handling file service for micro-computer users, background production data processing, and office systems support.

    - The absence of a data base product for the System/36 could be a major drawback when considering it for a departmental processor.

- IBM has earmarked the System/36 for the departmental processor/file server because the System/36 was designed for small businesses and, therefore, requires minimum technical support from the IS professionals. If a large corporation decided to install System/36s as part of its office systems archi-tecture, it would not have to provide the same level of systems programming support expected for the System/370 family.

- In October 1984 IBM announced several products for the System/36 to help integrate it into the IBM Office Systems Family, which included:

    - DisplayWrite/36, which is a DCA text editor similar to DisplayWrite 3. It is integrated with Personal Services/36 for document distribution and interchange.

    - Personal Services/36 includes distribution services to users of other Systems/36s, 5520s or DISOSS. It also includes mail handling, calendar, and directory services.

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- The PC can connect directly to a System/36 through a 5250 terminal emulation communication card. Communications can be local or to an IBM 5251 display controller. A PC linked to a System/36 can alternate between stand-alone PC mode and on-line terminal access to Personal Services/36.

- A System/36 running Personal Service/36 cannot yet connect to the PC Network running Personal Service/PC. This capability may not be available until the token-passing ring network is installed.

- It is clear that IBM is having as much difficulty, if not more, as the mini-computer vendors in attempting to mold the System/36 with the host-main-frame architecture. INPUT believes a version of the IBM 4300 would make more sense for a future integrated office automation, data processing, and personal computing system at the departmental level. The 4300 line is compatible with IBM's family of mainframes, including the systems software and peripherals. It also offers very wide range of configurations that allows more growth than the System/36/38. The System/36 would be a better choice if it is only expected to provide support for office automation and personal computing file service, because it requires less technical support and has a lower entry cost. If the departmental processor is expected to take over some of the data processing load from the host mainframe, then a 4300 should be considered.

B.   WHAT OTHER VENDORS ARE DOING

- The information services vendors other than IBM are also recognizing the opportunities and challenges created by the demand to link microcomputers to corporate production data bases. When the respondents to this study were asked who they thought would provide the most assistance in planning and implementing micro-to-mainframe applications, they identified IBM for the

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most amount of assistance and remote processing vendors for the least amount of assistance, as shown in Exhibit V-2.
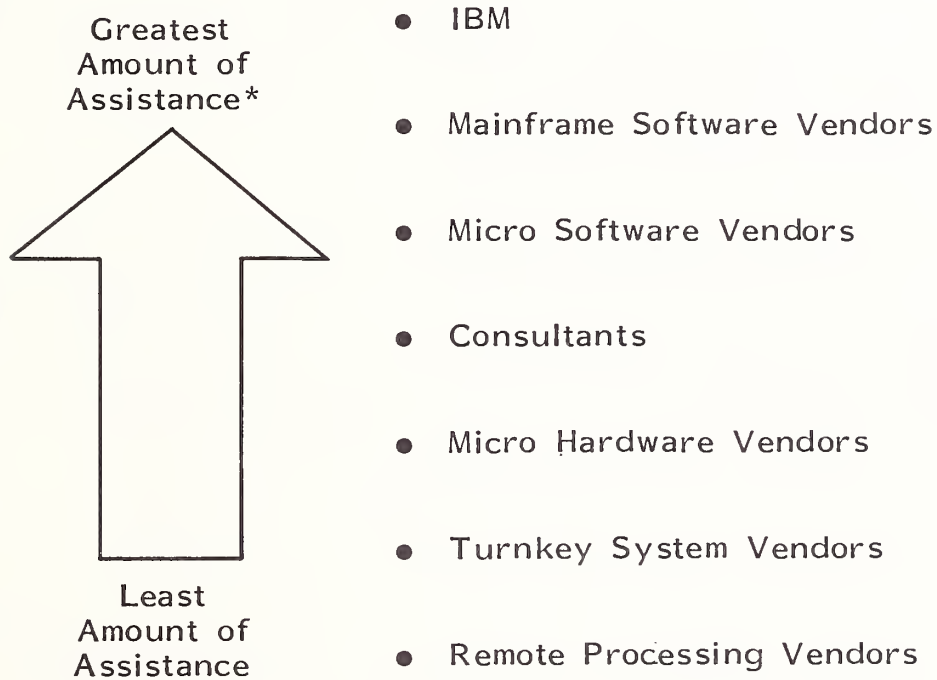
- The mainframe software vendors (e.g., Cullinet, Informatics, MSA, McCormack and Dodge, etc.) were edged out by IBM for the type of vendors most likely to lend assistance to the micro-to-mainframe issue, probably because there isn't a great deal of micro-mainframe activity as yet, and most everyone turns first to IBM for possible solutions to new information resource problems.

- INPUT believes that if a data center is heavily dependent on one mainframe software vendor to support major components of the base of productions systems, then that vendor will probably be expected to assist IS in identifying micro-to-mainframe solutions.

I. MAINFRAME SOFTWARE VENDORS

- There are primarily three categories of products associated with mainframe software that could require linkage to a microcomputer:

    - Specific business applications such as accounting, human resources, and manufacturing.

    - Data base management systems such as IDMS, TOTAL, ADABAS, Model 204, and IMS.

    - Fourth generation languages and decision support systems such as FOCUS, NOMAD2, RAMIS II, and EXPRESS.

- The major vendors within the above three categories developed micro-to-mainframe links for their products for two reasons: to remain competitive, and to sieze a new market opportunity. The price of this linkage software can run between $10,000 and $150,000 for the typical mainframe portion and anywhere from $200 to $2,000 per microcomputer copy.

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EXHIBIT V-2

USERS EXPECTATIONS FROM VENDORS FOR PLANNING
AND IMPLEMENTING M-M APPLICATIONS

Greatest
Amount of
Assistance*

- IBM

- Mainframe Software Vendors

- Micro Software Vendors

- Consultants

- Micro Hardware Vendors

- Turnkey System Vendors

Least
Amount of
Assistance

- Remote Processing Vendors

* Based on Average Rating

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- The big problem facing IS is trying to select a micro-to-mainframe link solution that handles all three categories of software products. For instance, it wouldn't be unusual to find a data center that had an accounting package from McCormack and Dodge, a data base management system from Cullinet, and a fourth generation language from Mathematica. The cost of the mainframe portion of these three typical links will run well over $100,000 and the microcomputer pieces could total close to $3,000 per set. Not only would the initial cost be a burden, but each link requires supporting resources. A few mainframe software vendors are attempting to provide the total solution. Cullinet is one of these vendors.

- Cullinet Software Incorporated is one of the industry leaders in mainframe data base products and recently entered the second category of applications products for manufacturing, finance, human resources and banking. In April 1985 Cullinet announced a new product to facilitate micro-to-mainframe links--Information Center Management System (ICMS).

- Cullinet's ICMS is comprised of four basic components:

    - Information Data Base (IDB). This piece of linkage software resides on the mainframe and allows direct access to IDMS/R and VSAM files through special dictionaries. It also allows retrieval of data from other data bases such as IBM's IMS through an optional facility.

    - End-User Computing Facility also resides on the mainframe and is comprised of application productivity tools that includes Cullinet's Automatic System Facility (ASF) that aids in building an application, and the OnLine Query (OLQ) which enables users to display ad hoc and production reports.

    - Open System Architecture. This is a significant component for the integration of office automation, personal computing, and data proces-

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sing for those organizations that use minicomputers from Data General, Digital Equipment, and Wang Laboratories. Each of these companies has signed agreements with Cullinet that will allow the users of their departmental systems to transparently access mainframe data through the IDB. Data General has already announced the availability of its IDB link software and DEC and Wang should be close behind.

- Universal Link and Symphony Link. These are the intelligent connection software packages that reside on the microcomputer under PC-DOS. The Universal Link works with virtually any micro software package that runs under PC-DOS and translates the IDB selected mainframe information into industry-standard micro file formats such as Data Interchange Format (DIF), ASCII, and Lotus 1-2-3 worksheet files (WKS). Symphony Link has the same general capabilities as the Universal Link except that it is designed specifically for Lotus Symphony and uses command style and work environment as extensions of Symphony. Symphony Link facilitates shared processing between the micro and the mainframe.

- The prerequisites for installing ICMS do not include Cullinet's IDMS data base management system or Cullinet's GOLDENGATE integrated PC software. ICMS may be acquired by itself for $150,000. Customers of IDMS pay $75,000 for the ICMS capabilities. Both micro link (Universal Link and Symphony Link) packages are priced at $300 per copy.

- INPUT cited Cullinet as an example because it believes that the concept of the universal link to and from many different microcomputer software packages and mainframe data bases and files is what will be needed in the future integrated environment. Just like any other piece of sophisticated systems software, these micro-mainframe link packages will require considerate support from IS.

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2. MICROCOMPUTER SOFTWARE VENDORS

- Because the biggest task in the micro-mainframe link is associated with selecting and reformatting data stored in host data bases, those vendors that are predominately microcomputer software suppliers are not inclined to develop linkage software.

- There could be a move toward more agreements between mainframe and microcomputer software vendors to jointly develop links such as the Lotus-Cullinet venture. This makes sense because each vendor would be adding capabilities to their own proprietary packages. The linkage software would become an integral part of the total system and more transparent to the end users. Ashton-Tate has mentioned building link hooks into its products to facilitate linkage software.

- INPUT believes that those vendors that primarily market mainframe applications software will be forced to get into the microcomputer software business. This will happen in support of stage six, outlined in Chapter III, where the microcomputer becomes an extension of the mainframe and actually performs many of the front-end and back-end tasks of an operational production systems (e.g., accounting, manufacturing, purchasing, etc.). MSA has started this trend with its announcement of Distributed PC Applications.

- There is another category of vendors that are doing quite well by concentrating solely on the micro-to-mainframe market. Two such vendors are Micro Tempus Inc. and Digital Communications Associates.

- Micro Tempus markets Tempus-Link and Tempus-Data, which are aimed directly at the micro-to-mainframe market. These products are based on the virtual floppy disk concept where microcomputer users can access micro-compatible mainframe disks as if they were additional floppy disks. To upload or download, a menu system is used to specify the mainframe file name, the virtual disk number and the micro file name. The system supports formatting

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in both DIF and ASCII files. The Tempus-Data package handles the selection, extraction and updating of mainframe data from the microcomputer environment. Output from Tempus-Data can be written to any mainframe file and also to Tempus-Link virtual disks. Exhibit V-3 illustrates how the Micro-Tempus products perform the micro-to-mainframe linkage.

- Even though the virtual floppy disk concept provides a great deal of flexibility that allows multiple microcomputer users access to the same virtual disks, the obvious drawback to this approach is the possible burden on the mainframe disk capacity. If several hundred end users all started building and saving separate virtual floppy disks, mainframe disk management would become a major problem.

- Digital Communications Associates, Inc. (DCA) markets the family of hardware and software products named IRMA. The original IRMA is a full-sized printed circuit board designed for use with an IBM PC or compatible and provides 3278/79 terminal emulation via coaxial cable to IBM 3274/3276 controllers. IRMA includes file transfer software. IRMAline provides remote access to IBM 3270 terminal controllers for PCs and asynchronous terminals. The RS-232 port of IRMAline accommodates a full duplex modem connection. There are several other DCA products that accommodate PC links over asynchronous and synchronous communications lines, including IBM's SNA/SDLC protocols.

- The IRMA board, as it has become to be known, is widely used because this type of board is the basis for any data transfer from the mainframe to a PC that requires terminal emulation. For a few requests from PC users for file transfers from the mainframe, IRMA, along with extract and reformat programs, could satisfy the micro-to-mainframe demands. Normally, the acquisition of IRMA boards is followed by the acquisition of linkage software such as Tempus-Link as the demands increase and become more varied. Exhibit V-4 illustrates the IRMA uses.
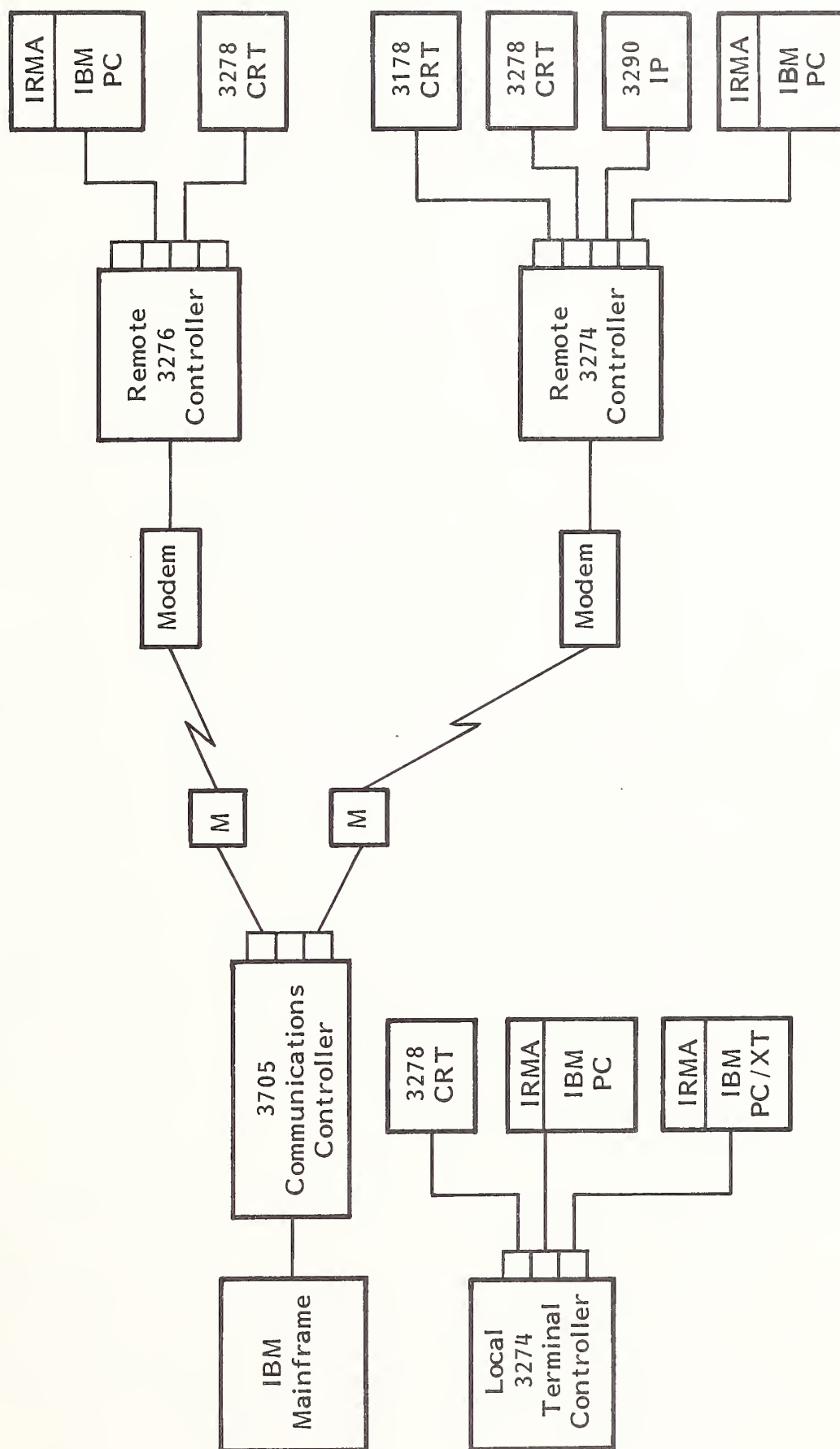
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EXHIBIT V-3

ILLUSTRATION OF TEMPUS-LINK

Virtual Floppies
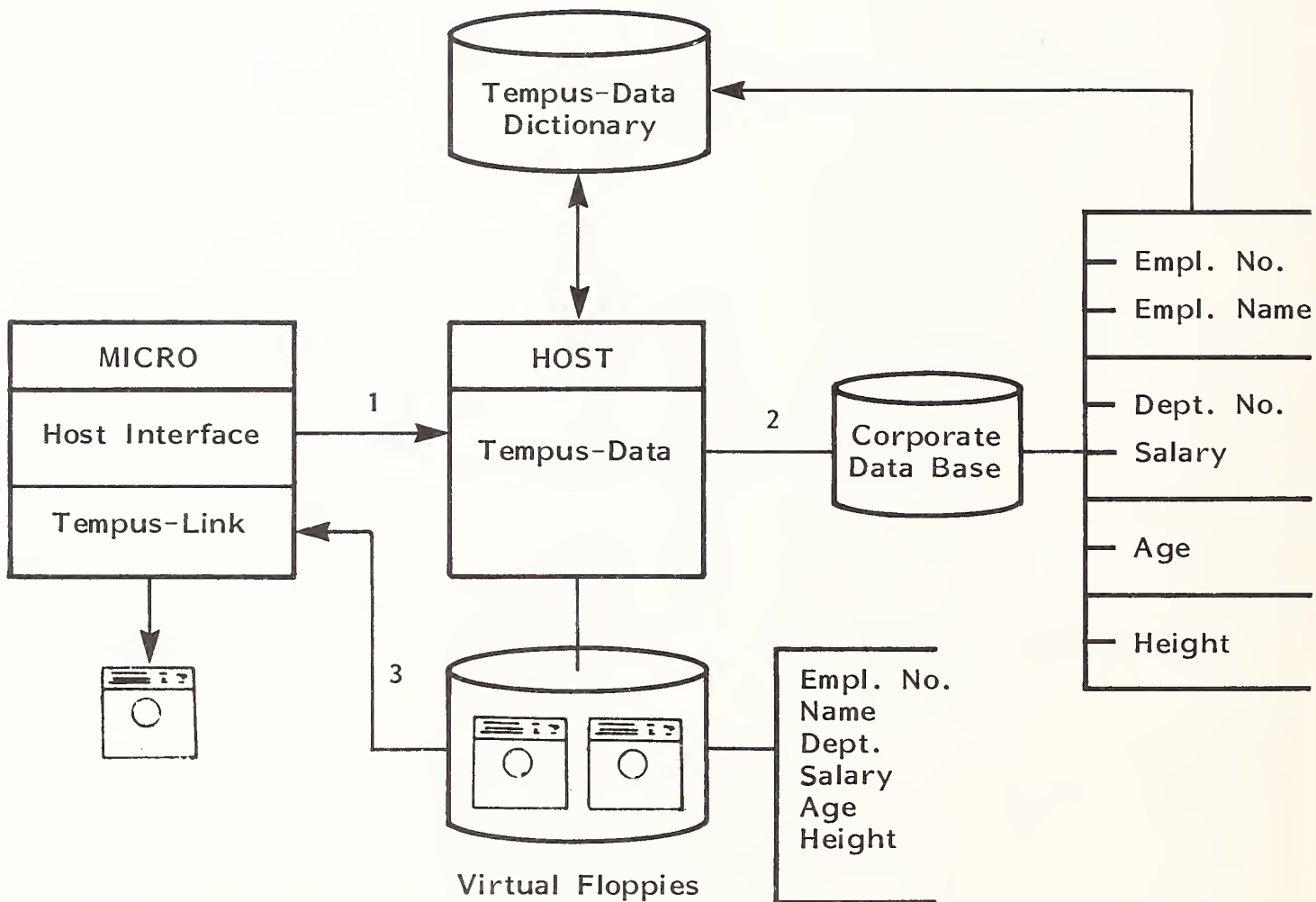
1 = User Submits Extract Request

2 = Tempus-Data Extracts Data to
    Virtual Disk File

3 = Copy Extracted File to Micro or Read
    Directly Into Micro Application

EXHIBIT V-4

ILLUSTRATION OF IRMA CONNECTIONS

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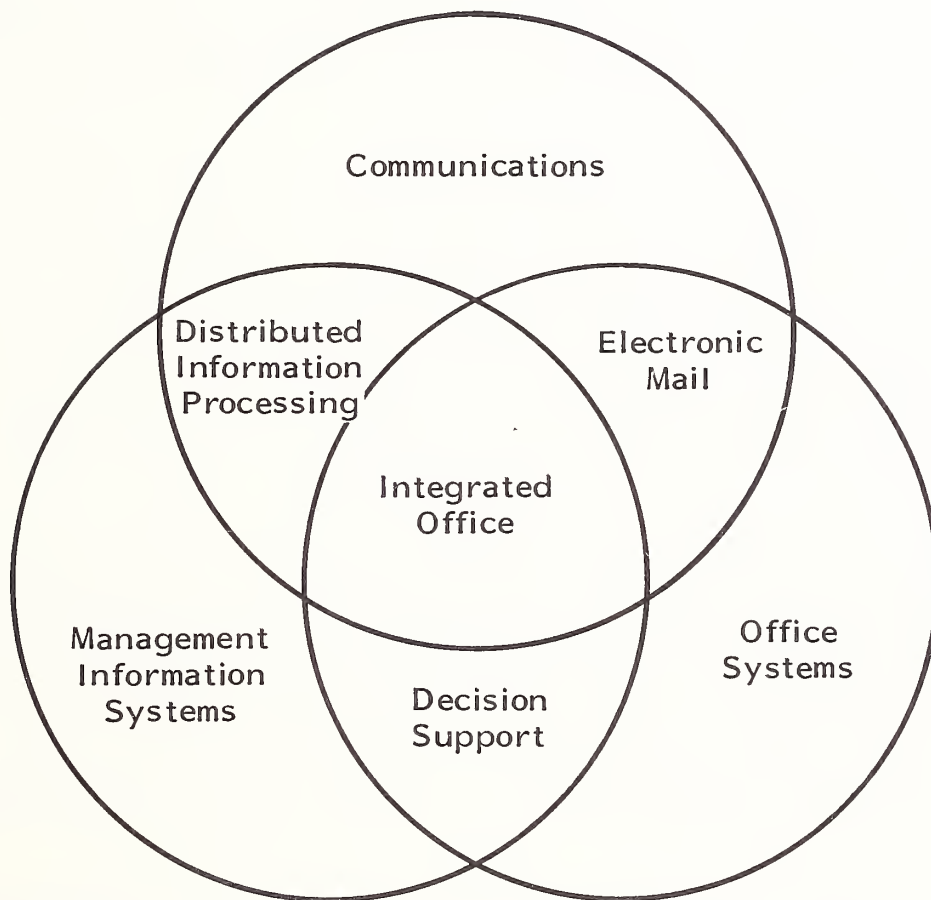UCMM

3. MINICOMPUTER VENDORS

- The opening paragraph in one of the brochures from Data General sums up that vendor's intentions to capture a piece of the integrated data processing and office systems market:

  - "Data General's COMPREHENSIVE ELECTRONIC OFFICE (CEO) is an integrated, interactive, business automation product designed from the ground up to mirror office processes. The CEO system automates the communication process among all office workers and lets them handle complex data processing and business applications using one system and one terminal. More than just second generation office solutions tied together, Data General's CEO system is setting the standards for true business automation."

- Data General states that CEO integrates office processing through word processing, electronic mail and filing, administrative and decision support, and distributed data processing. CEO runs on the 32-bit MV Eclipse minicomputer and costs around $6,000 per workstation in a 100 workstation CEO configuration.

- Data General realizes that in order to penetrate the corporate market it must co-exist with IBM and provide value added through its office automation and distributed data processing capabilities. Not only has DG developed communications products that adhere to the SNA de facto standard, but it offers an interface that lets the IBM PC act as a CEO workstation.

- Recently DG announced a link between its MV/Family of processors and the IBM mainframes. The product is called AOS/VS Decision Connection. AOS/VS is DG's Advanced Operating System/Virtual Storage. The link ties in via SNA with Cullinet's IDB running on the IBM mainframe. IDB is capable of providing access to a variety of data managers, including Cullinet's IDMS/R, IBM's VSAM and IMS, and Cincom's TOTAL.

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- The DG CEO Connection software moves and converts files between an Eclipse MV host running CEO and a variety of popular MS/DOS software packages residing on the Data General/One Personal System or the IBM PC. With CEO Connection the Data General/One and IBM PC user can:

  - Mail a document from their personal computer to the MV host.

  - Retrieve a document from the MV host.

  - Log-on to CEO automatically and act as a terminal.

  - Move print image spreadsheet data to CEO.

  - Use the DG file transfer utilities (BLAST).

- DG is committed to the open systems strategy that allows their products to fit into a variety of existing IBM systems configurations. Along with the DG/SNA product, DG systems can connect to Ethernet LAN, X.25 packet-switching network, and PBX communications options. By mid-1985 DG will also have a DIA/DCA product to provide further compatibility with IBM.

- Digital Equipment Corporation (DEC) who has built its reputation on servicing the emerging computing community has also realized the opportunities made available in the area of office automation.

- DEC's handbook for its product named All-in-1 Office and Information System starts out:

  - "An office and information system is not a single product, or a group of products, but rather a capability that allows you to tie together many different types of technologies, management, information systems, communication systems, and office systems into an integrated and easy-to-use system that's accessible from a single computer terminal."

INPUT

- Exhibit V-5 symbolizes DEC's strategy to provide total solutions through the integrated office concept. DEC builds its products around the DECnet/VAX architecture to be certain that all products will remain compatible, and to allow customers to start with any size configuration and grow.

- Along with office applications such as word processing, electronic mail, desk management, spreadsheets, and graphics, All-in-1 also provides information management, data base query and reporting through such products as Multiplan from Microsoft Corporation and Empire from Applied Data Research, Incorporated.

- The Digital Network Architecture (DNA) is a flexible communications architecture that satisfies many network requirements. DNA interfaces efficiently with Ethernet's communications capabilities and is the basic for the design of all DECnet software products. DNA provides four communications servers for use on Ethernet:

  - Terminal Server, connect multiple terminals to one or more systems on a network.

  - DECnet Router Server, transfers data packets between DECnet network.

  - DECnet Router/X.25 Gateway, provides routing through an X.25 service.

  - DECnet/SNA Gateway, allows an Ethernet host to communicate with IBM SNA systems.

- As has Data General, DEC is in the process of developing linkage software that will enable All-in-1 users to access IBM mainframe data through the DECnet/SNA Gateway and Cullinet's IDB linkage software. As of this writing no delivery date has been announced for this mini-to-mainframe link product.

INPUT

EXHIBIT V-5

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DEC'S SYMBOL OF
OFFICE AND INFORMATION SYSTEMS

Communications

Distributed
Information
Processing

Electronic
Mail

Integrated
Office

Management
Information
Systems

Decision
Support

Office
Systems

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- DEC provides a wide range of 32-bit minicomputers between its VAX family and PDP-11 family of processors. It also offers a variety of workstations, as illustrated in Exhibit V-6, all of which are compatible.

- Wang Laboratories Inc. has a reputation of being a leader in word processors with the Wangwriter. Wang has one of the most widely used dedicated word processing systems. With the tremendous penetration into the corporate office environment, it was a logical move for Wang to expand its capabilities to include the office automation and data processing functions offered from DEC and DG.

- Wang's Office Information System (OIS) has a wide range of models to choose from, all of which are compatible for easy upgrade. Wang's VS65 32-bit minicomputer is aimed at the IBM System/36 market with basic purchase price of $19,000 (CPU and memory). The top of the line VS300 CPU is a 64-bit processor with maximum memory size of 16 megabytes and basic price of $170,000.

- Wang's systems support industry standard communication protocols including asynchronous, synchronous, binary, X.25 and IBM's SNA/SDLC to provide an assortment of telecommunications and network options. It has also signed a joint development agreement with Cullinet to offer a link between the VS systems and the IBM mainframes using the IDB linkage software.

- The Wang 75PC-T Professional Computer has both fixed and removable 10 M-byte Winchester disk drives and can emulate the IBM PC and run most IBM PC-DOS software. The Professional Computer runs many popular applications software packages including Lotus 1-2-3, VisiOn, Alpha Software Inc.'s Data Base Manager II, and Microsoft Corp.'s Multiplan. Wang markets this third-party software under its Distributed Software Program.

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EXHIBIT V-6

DEC'S HIERARCHY OF WORKSTATIONS
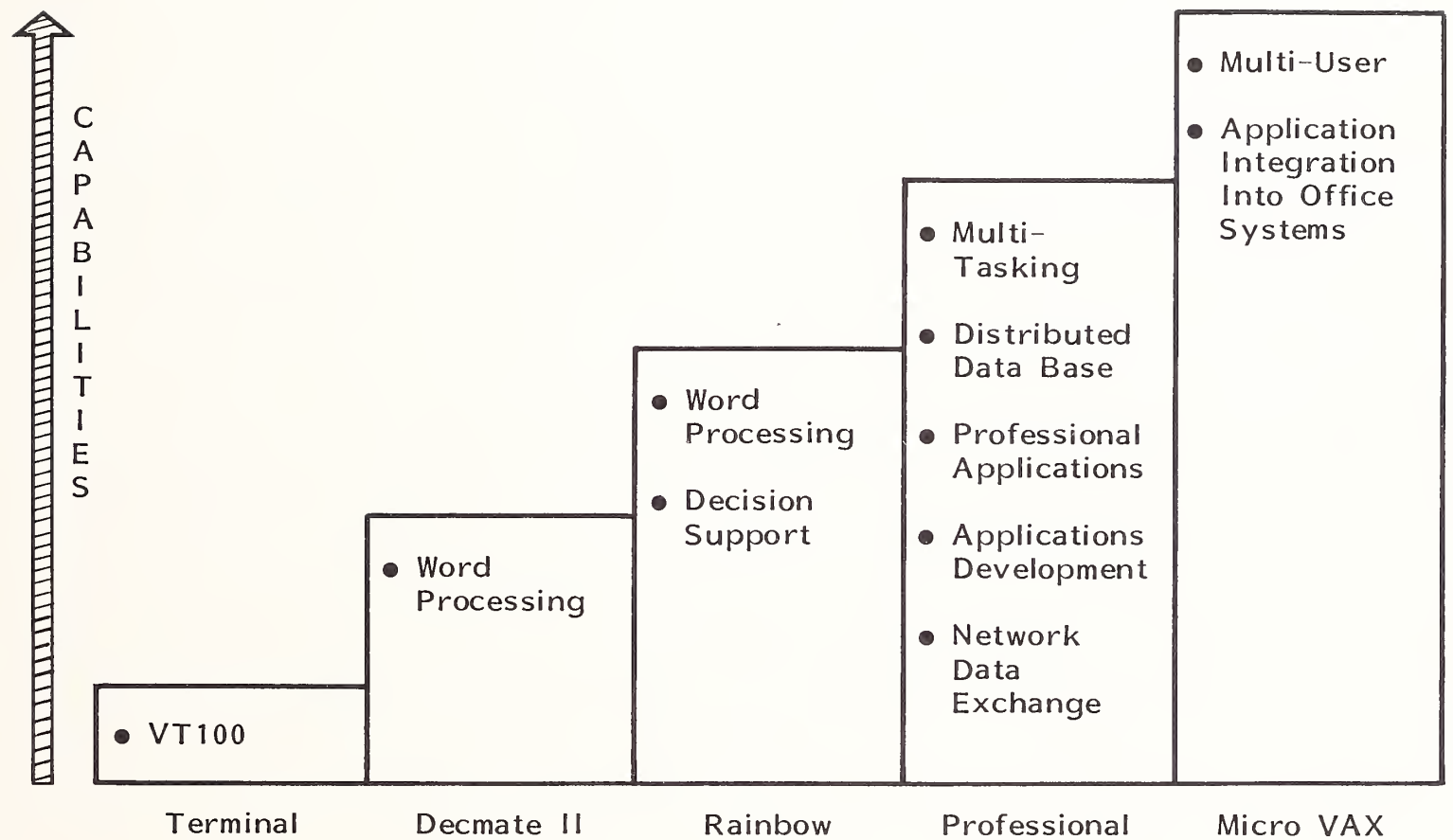
- The minicomputer vendors such as DG, DEC, and Wang have an impressive array of products that can provide the missing link between departmental information system needs and the corporate IBM mainframe data center. The biggest problem facing these vendors is getting IS's attention. These vendors have not traditionally sold their products to the IS professional, but rather to the engineers, researchers and office personnel. INPUT believes it is in the best interest of the enterprize for IS to include these vendors in the evaluation of departmental processors and the electronic office concepts.

INPUT

VI CONCLUSIONS AND RECOMMENDATIONS

VI   CONCLUSIONS AND RECOMMENDATIONS

A.   CONCLUSIONS

- During the past four or five years the microcomputer has evolved in large businesses from a standalone, single application device to an integral component of an office systems architecture, capable of sharing data, documents, and processing power with other microcomputers, minicomputers, or host mainframes.

- More than 75% of the currently installed microcomputers in business are operating in a standalone environment. By 1987 that figure will drop to 45% and the majority of minicomputers will have links to mainframes either directly or through local area networks.

- The demand for links between the mainframe data bases/files and the micro-computers is being initiated by the decision makers--middle management, financial and business analysts, and senior management.

- The available microcomputer software is capable of providing the computing functions necessary to perform decision support analysis, but without timely access to the corporate data stored in mainframe data bases the effectiveness of this software is reduced.

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INPUT

- IS has found itself in a reactive mode on issues pertaining to microcomputer usage, and the micro-mainframe link issue is no different. IS management has tended to assign the responsibility for these issues to the information center or end-user support group with little or no strategic direction.

- IS management's concerns regarding micro-mainframe links include:

    - Host mainframe and disk capacity problems.

    - Network communication traffic problems.

    - Cost of linkage software and additional communications hardware.

    - Cost of additional required technical support.

    - Additional security and data integraty problems.

    - Cost justification and charge back.

    - Increased training and education requirements.

- IS will eventually regain control of the direction of information technology through the integration of end-user computing, office systems, and data processing. The microcomputer is the strategic component of the future integrated electronic office.

- Historically, IS's energies have gone into modifying and enhancing the major production systems, which normally have a life span of five to ten years. This is the main reason that IS management has assigned the end-user computing issues to the information center and has not involved the systems development staff to any extent in micro-mainframe planning.

INPUT

- The top independent mainframe software vendors are providing micro-main-frame links through their proprietary packages. These are very expensive ($10,000-150,000/mainframe; $200-2,000/micro) and difficult to justify for a handful of end users. This approach will make more sense as IS finds ways to build micros into production systems.

- Open-ended, or generic links, fit a variety of data base environments and microcomputer software and are generally less than application specific links, but usually require more IS technical support, especially in the area of data base selections and extractions.

- Along with demands for access to mainframe data bases from micros to popular micro software, there is a growing need for micros to be tied into office systems.

- IBM is touting the System/36 as the department processor and/or file server to compete against DG, DEC, and Wang in this area. IBM has announced office systems products for the System/36 to provide text, mail and library applications that are complementary to functions performed on the host mainframes and PCs.

- The departmental processor concept links the local microcomputer users to a minicomputer which in term is connected to the mainframe. This will alleviate the mainframe capacity and communication traffic problem. The micros can be connected to the minis through LAN's, as well as individually in a star network.

- There is an indication that many future operational production systems will be designed around the capabilities of the microcomputer. Work groups will use the micro for data collection, report preparation (modeling, analysis, graphics, etc.), and in support of their local DP needs, including office systems.

INPUT

●   Until the micro-mainframe concepts encompass office automation tasks and data processing functions that will offload the mainframe processing, there will be a drain on the mainframe capacity caused by data selection extraction and downloading to microcomputers.

●   The structure of the IS organization will be impacted by micro-mainframe technology. As the integration of office systems, data processing and personal computing evolves, there will be a greater need for collaboration between the end-user support group and the systems development staff. Eventually, these two functions will merge to form an electronic office systems team. A formal training and education function will emerge, which will report near the top of the IS organization to accommodate the increasing end-user training requirements.

B.   RECOMMENDATIONS

●   Exhibit VI-I summarizes the recommended action items for IS regarding micro-mainframe applications.

●   First and foremost, IS should be reviewing and satisfying the requests for micro-mainframe file downloading. This should be accomplished quickly and as inexpensively as possible; probably with a simple generic link and in-house programming. From this action the end users will perceive IS as being responsive to the data access problem. It will also buy the time that is required to study the overall information interchange problems and establish strategies.

●   The IS management should conduct strategic planning sessions with the IS department heads of:

-       Systems development.

INPUT

EXHIBIT VI-1

ACTION ITEMS FOR MICRO-MAINFRAME APPLICATIONS

- Satisfy Initial M-M Request Quickly and In-expensively

- Conduct IS Strategic Planning Sessions

    - Establish Office Systems Direction

    - Discuss M-M Opportunities

    - Evaluate Merits of Departmental Processors

    - Discuss Communication Network Require-ments

    - Determine End-User Needs

- Form a Micro-Mainframe Task Force

- View Micro-Mainframe Concepts:

    - From a Corporate Perspective

    - In Light of Office Systems Integration

    - For Future Production Systems

- Identify Potential M-M Applications

- Conduct Conceptual Cost/Benefit Analysis

- Establish Applications Priorties and Schedules

- Present Plan to IS Management and to the IS Steering Committee

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- End-user support.

- Data center operations.

- Technical support.

- Training and education.

- Communications.

● These planning sessions should be devoted to establishing the conceptual direction of the information services. The following issues should be addressed:

- The merits of greater decentralization.

- The status of major production systems (state of obsolescence).

- The projected work load of the information center.

- Projected end-user training needs.

- Projected communication network requirements.

- The possible use of departmental processors/file servers.

- Requirements for full information interchange among workers throughout the corporation.

- The potential applications for micro-mainframe technology.

- The life cycle of future systems.

INPUT

- From these planning sessions the IS management staff will have a mutual understanding of the direction in which the IS organization is headed. The department heads will be aware of the problems and opportunities facing each IS department. The staff will be in a better position to consider how the micro-mainframe technology can serve the objectives of the corporation.

- In order to evaluate micro-mainframe products and arrive at a recommendation, the problems to be solved by these links must be identified. A micro-mainframe application servicing 100 users could easily cost a quarter of a million dollars to install, just for the license fees and terminal emulation hardware.

- After the IS general planning sessions are conducted a task force should be formed to investigate opportunities for micro-mainframe concepts. The investigation should include potential applications in office systems, personal computing (decision support), and data processing. The task force should be comprised of members from the information center or end-user support, the systems development staff, and key users. INPUT recommends that a senior systems analyst chair the task force because of the overall systems implications.

- The charter of this task force would be to develop a plan that would identify the potential micro-mainframe applications and establish priorities and schedules. The planning would include the evaluation of file/communication servers and possible distributed data processing. For each phase of the plan there would be a list of the hardware, software, and communications requirements along with the associated costs. These plans should be presented to the IS management first and then to the IS Steering Committee for approval.

- The micro-mainframe plans should be conceptual and should reflect the potential tangible and intangible benefits that could be realized, such as data accessibility for effective decision support and reduced mainframe growth through distributed offloading.

INPUT

- In selecting micro-mainframe products, INPUT recommends considering only those products that support the current IS environment, which includes:

  - Operating Systems (Micro and Mainframe).

  - Mainframe Data Management.

  - Microcomputer File Formats.

  - Mainframe/Micro Hardware.

  - Existing Mainframe Security System.

- INPUT also recommends including for consideration, at least, IBM, DEC, Data General, and Wang Laboratories for the office systems component of an integrated electronic office. Each of these vendors have developed systems of hardware and software directed at filling the need for personal computing, office automation, and data processing at the departmental level with connectability to the IBM host mainframes.

- The driving force for micro-mainframe applications must shift from the end uses to IS. Taking full advantage of the power and capabilities of the micro-computer will be realized through top-down planning that focuses on the global requirements of the corporation.

- Without, at least, a conceptual strategic plan for a corporatewide office systems network, the micro-mainframe applications will emerge in a haphazard manner and gradually consume the IS resources. Without a plan a hodge-podge of micro-mainframe products could be acquired, which would be difficult for IS to support and costly to the corporations. But most importantly, without a plan the most worthwhile micro-mainframe applications may go undiscovered.

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